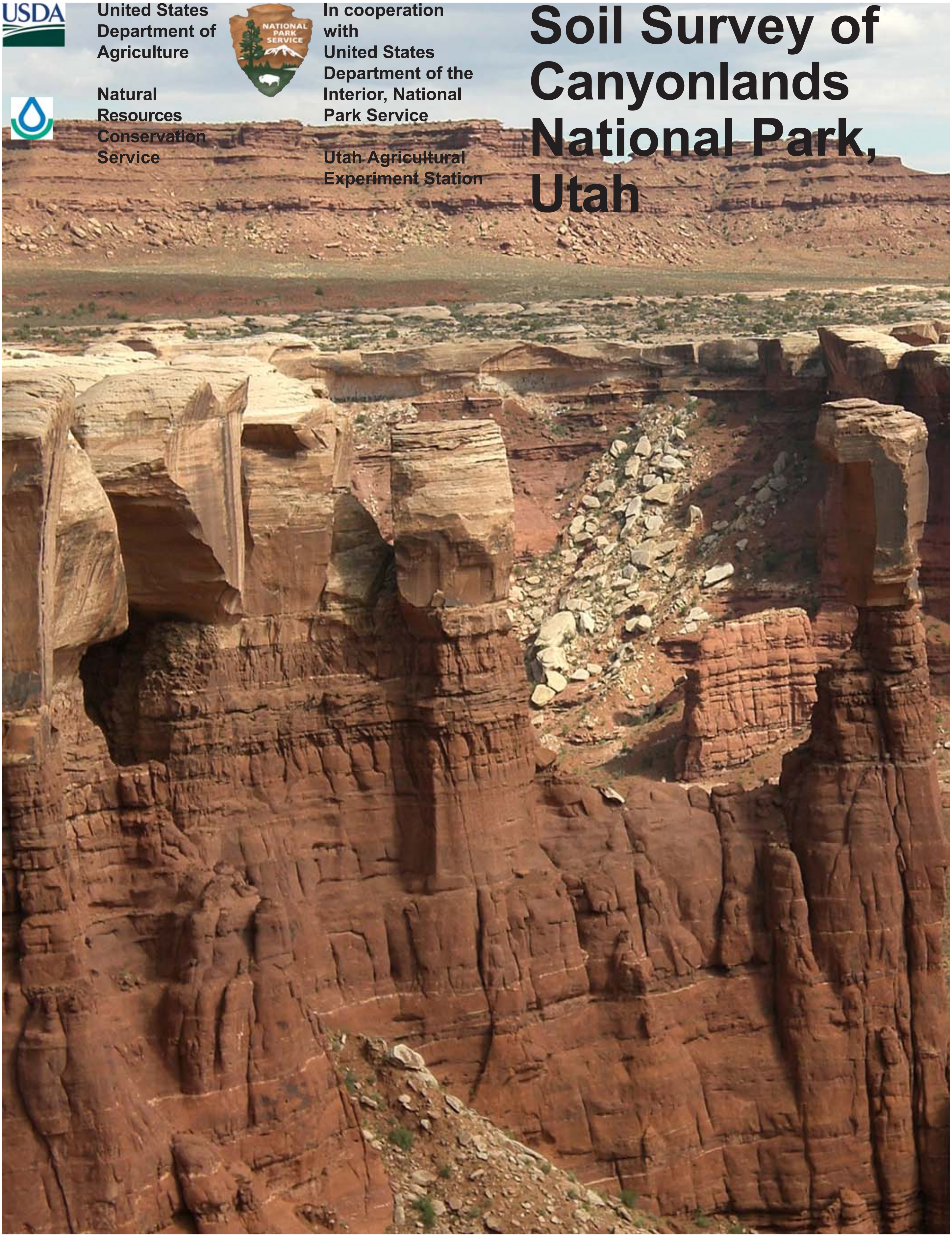

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation
with
United States
Department of the
Interior, National
Park Service

Utah Agricultural
Experiment Station

Soil Survey of Canyonlands National Park, Utah

How To Use This Soil Survey

The information provided in this publication can be useful in planning the use and management of small areas. The text includes descriptions of detailed soil map units and provides an explanation of the information presented in the tables. The publication also includes a glossary of terms used in the text and tables and a list of references. Bookmarks and links in the publication allow the user to navigate from one part of the text to another. Maps showing soil lines and map unit symbols can be accessed for a particular area of interest through the Web Soil Survey of the Natural Resources Conservation Service, accessible at http://websoilsurveynrcs.usda.gov/app/. The symbols on the map represent the detailed soil map units in the area. These map units are listed in the bookmarks panel of the text. Information about the map units can be accessed by clicking on the appropriate bookmark.

The bookmarks panel corresponds to the Contents and allows the user to navigate easily throughout the book.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies; State agencies, including the Agricultural Experiment Stations; and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2009. Soil names and descriptions were approved in 2009. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2009. This survey was made cooperatively by the Natural Resources Conservation Service and the National Park Service, the Bureau of Land Management, the United States Geological Survey, and Utah State University, Logan, Utah.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

The correct citation for this soil survey is as follows: United States Department of Agriculture, Natural Resources Conservation Service. 2010. Soil Survey of Canyonlands National Park, Utah. Accessible online at: http://soils.usda.gov/survey/printed_surveys/.

Cover: View from the White Rim Road, Island in the Sky District.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

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Foreword

This soil survey was developed in conjunction with the National Park Service Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Canyonlands National Park.

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Planners and engineers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in ecology, recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey, sandy, or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations. These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil.

Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service, as well as the National Park Service Natural Resources Program Center.

Silvia Gillen
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Canyonlands National Park, Utah

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Fieldwork by Catherine E. Scott, Brian M. McMullen, and Keith W. Crossland, Natural Resources Conservation Service

Ecological Site Assessment by Dana K. Truman, Ashley Garrelts, and Jacob M. Owens, Natural Resources Conservation Service

Archaeological Clearance and Assessment by Brendan Fitzsimons, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with United States Department of the Interior, National Park Service

General Nature of the Survey Area

Canyonlands National Park is located in southeastern Utah and covers parts of San Juan, Grand, Wayne, and Garfield Counties (fig. 1). It is 337,570 acres in size. The area is irregular in shape and consists of mesas, canyons, structural benches, river floodplains, and terraces.

One early advocate for preservation of the natural beauty of the Canyonlands area was Bates Wilson, superintendent of Arches National Monument. In the 1950's Wilson led visitors into the area, lobbying for the creation of a "Grand View National Park." On September 12, 1964, President Lyndon B. Johnson signed legislation establishing Canyonlands National Park. Originally consisting of 257,640 acres, the Park was expanded in 1971 to its present size.

Canyonlands National Park is located in the eastern part of San Juan County, the western part of Wayne County, and northeastern Garfield County. There is a very small acreage in the southern part of Grand County as well. The Orange Cliffs portion of the Glen Canyon National Recreation Area borders Canyonlands National Park on the west. Bureau of Land Management land lies to the south, north, and east of the main body of the Park, and there are small areas of land owned by the State of Utah along the borders as well. There are approximately 30 miles of paved roads in the Park and hundreds of miles of non-paved, four-wheel-drive roads. Hundreds of miles of hiking trails provide access to the most remote areas of the Park, and vary from easy to strenuous.

The Park is divided into several Districts (fig. 2), which are accessible by different routes. Island in the Sky can be reached from Utah Highway 313 via US Highway 191. The Needles District may be accessed from Utah Highway 211 via US Highway 191. The Maze District can be accessed by a four-wheel-drive road via Utah Highway 24, and by another four-wheel-drive road from US Highway 91. Horseshoe Canyon, a detached unit of the Maze District, can be reached by a dirt two-wheel-drive road via Utah Highway 24. The River District is accessible primarily by boat, although several

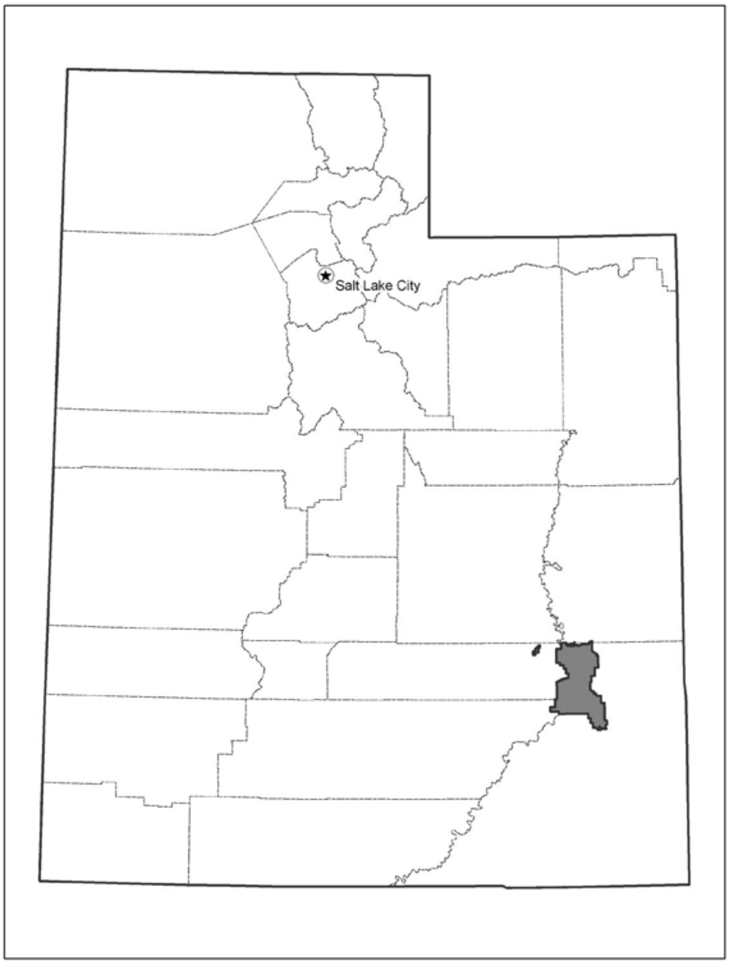


Figure 1.—Location of Canyonlands National Park in Utah.

foot trails to the River District exist as well. All boat launching areas are located outside the Park.

The closest towns to the Park are Moab, Utah (population 5,121), about 22 miles to the northeast of Island in the Sky District; Hanksville, Utah (population 360), about 92 miles to the northwest; and Monticello, Utah (population 2,018), approximately 60 miles to the southeast. The area between these towns is extremely rural, with widely scattered ranches.

Physiography

Canyonlands National Park is located in the Canyon Lands section of the Colorado Plateau. The Green River enters the main body of the Park in the northwest corner, and the Colorado River enters in the northeast. The Green River flows into the Colorado River at The Confluence in the south-central area of the Park, and the Colorado River flows out of the park in the southwest corner.

The Island in the Sky District, the most accessible of the park's districts, is bordered on the east by the Colorado River and on the west by the Green River. The Island in the Sky Mesa, in the middle of the district, is the highest level in the stratigraphy of the district. A few thousand feet below the Mesa, on a structural bench, is the White Rim. The floodplains and terraces of the Colorado and Green Rivers lie about a thousand feet below the White Rim.

There are three smaller mesas in the district other than Island in the Sky Mesa; Buck, Steer, and Bighorn Mesas in the northeast portion of the district surround a meteor impact crater called Upheaval Dome.

Some important named features on Island in the Sky Mesa are Red Sea Flat in the northeast, Grays Pasture and Willow Flat in the center, and Grand View Point at the southern tip. Other mesa features include The Neck, a narrow section of the mesa between Grays Pasture and Red Sea Flat; Aztec Butte, north of Willow Flat; and Whale Rock, east of Upheaval Dome.

Many large, deep canyons cut through the landscape from Island in the Sky Mesa down to the rivers on the east and west. Taylor and Upheaval Canyons trend westward into the Green River, along with Potato Bottom, Holman Spring, and Twins Basins. On the east side of the mesa, Shafer, Musselman, Gooseberry, Lathrop, Buck, and Dog Leg Canyons empty to the Colorado River. Other points of interest on

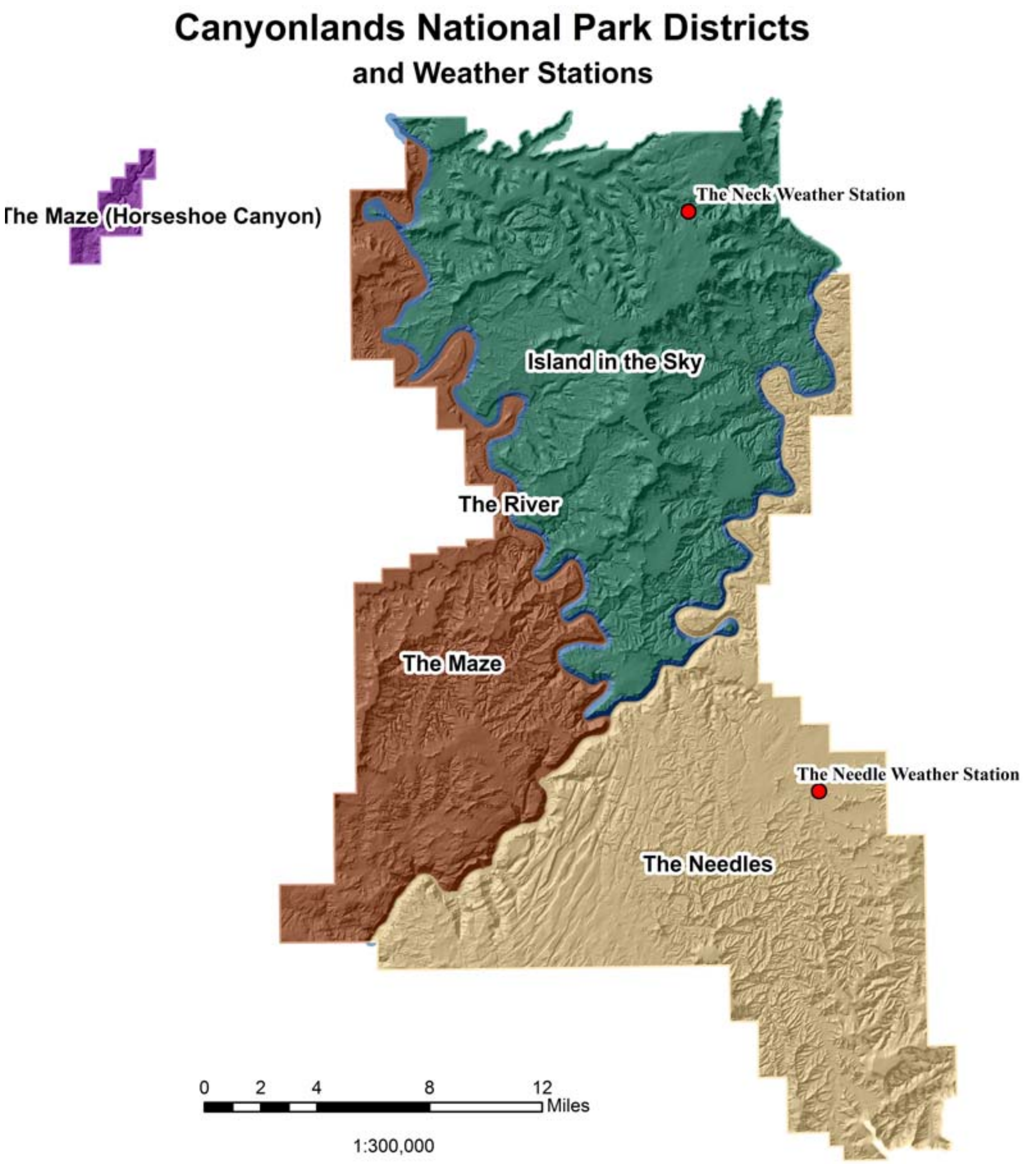


Figure 2.—Canyonlands National Park Districts and Weather Stations. (The Arches National Park weather station was also used in this soil survey, but is not shown on the map).

the east side are Musselman and Washer Woman Arches, Monster and Airport Towers, Black Crack, and White Crack.

In the Needles District, Salt Creek flows north into the Colorado River. Butler Wash also ends eventually in the Colorado River. Canyons of note in the Needles District include Lavender and Davis Canyons in the southeast; Horse Canyon, which enters Salt Creek about 3 miles south of the Needles park entrance; and Big Spring and Elephant Canyons, which cut through the center of the district from south to north to end in the Colorado River. In the southwest part of the Needles District is an area called the Grabens, which consists of thin, fault-caused valleys trending southwest to northeast, divided by narrow mesas. Some grabens of note include Upper Red Lake and Red Lake Canyons; Aztec, Cyclone, Lens C, Cow, and Deep Canyons; and Devils Lane. Canyons that trend southeast to northwest, perpendicular to the grabens, include Cross Canyon, Lower Red Lake Canyon, and Y Canyon. Other major physiographic features in the Needles District include the Needles, Chesler Park, Squaw Flat, and Salt Creek Pocket.

The Maze District is the westernmost portion of the main body of the Park. Ernie Country is in the southern part of this district, and is bounded on the southeast by Cataract Canyon on the Colorado River and by The Fins on the north. Side Valley and Main Flat are the most easily accessed areas of Ernie Country. Teapot and Range Canyons trend roughly eastward and empty into the Colorado River.

North of Ernie Country is the mesa known as Land of Standing Rocks, the most accessible and most visited area of the Maze. Many distinctive rock formations are in this area, including The Wall, Standing Rock, The Plug, Chimney Rock, and The Dollhouse.

Farther to the north is the area known as The Maze, a region of deep, narrow canyons and side canyons that do in fact resemble a maze. Named canyons in this area include Water, Shot, Jasper, Horse, and South Fork; all empty into the Green River to the northeast. Other features of note are Elaterite Butte and the Chocolate Drops. Pete’s Mesa and Elaterite Basin (Maze Overlook) are mesas raised above the Maze canyons.

Horseshoe Canyon is a detached unit of Canyonlands National Park, located about 10 miles west of the northwest corner of the main park unit. The dominant natural feature of this unit is Horseshoe Canyon, which bisects the unit from southwest to northeast. The smaller Water Canyon enters Horseshoe Canyon at about the midpoint of the unit.

The River District includes the Green and Colorado Rivers, as well as the floodplain and river terraces along their banks. Along the rivers, the important named features are a series of wide floodplain and terrace areas. On the Green River, Upheaval, Fort, Valentine, Potato, Beaver, Anderson, Queen Anne, and Tuxedo Bottoms are major features. The portion of the Green River within the Park boundary is known as Stillwater Canyon. On the Colorado River, the floodplains are much narrower, with only two named features, Sheep and Spanish Bottoms. South of The Confluence, the Colorado River narrows as it travels through Cataract Canyon. A series of rapids, including Brown Betty, Mile Long, and Big Drop, stretches from Spanish Bottom to the Park’s southern boundary.

The highest point in the Park (2,180 meters) is in the Needles District, at the top of the escarpment below Salt Creek Mesa. The lowest point (1,140 meters) is in the Maze District, where the Colorado River exits the Park’s southern boundary. Perennial water flows in the Colorado and Green Rivers, as well as in Salt Creek in the Needles District. Many natural water sources are intermittent in nature and include numerous springs and seeps. Water also collects in bedrock potholes after rains. Most of the washes have water only following significant rainfall.

Climate

The variation in elevation and the rugged topography of Canyonlands National Park produce considerable variation in temperature and precipitation. The topography can be divided into three groups of landforms: the high mesas, typified by the Island in the Sky area; the intermediate benches of the Needles area and much of the Maze; and the low benches and canyons from the White Rim down to the Green and Colorado Rivers. In the accompanying tables the data from the weather station at Canyonlands, the Neck, at 5,930 feet, is typical of the high mesas. Data from the station at Canyonlands, the Needle, at 5,040 feet, is typical of the intermediate elevations. Data from the Arches National Park Headquarters weather station, at 4,130 feet, is representative of the lower elevations, although this area appears to be slightly more moist than similar elevations within Canyonlands National Park. Locations of the weather stations within the Park are noted in figure 2.

Local topography also plays a part in the temperatures and moisture available for plant growth. An example of this can be found in comparing the temperatures for the Neck and the Needle weather stations. Even though the Neck is 900 feet higher in elevation, the average annual air temperature is slightly higher than that of the Needle, 52.6 degrees F. as compared with 52.3 degrees F. The average maximum temperatures follow the expected pattern of being 1 to 4 degrees lower at the higher elevation (the Neck). The average minimum temperatures are 1 to 4 degrees higher at the Neck than the Needle. A possible reason for this anomaly is the topography around the weather stations; the Neck is on a very narrow part of the mesa and cold air easily drains down to the White Rim, whereas the Needle weather station is on a broad structural bench with limited opportunity for cold air to drain downslope. Another common example of the influence of local topography on climate is the more lush growth of vegetation on north-facing slopes as compared to the adjacent south-facing areas.

Precipitation is distributed roughly evenly between the active growing season and the dormant period. The precipitation in the winter months is usually deposited by frontal storms moving from the west. Most of the summer precipitation is produced by thunderstorms, as moist air from the Gulf of Mexico moves across the area from the south or southeast or as Pacific moisture is entrained in air flowing from the southwest. On average, June is the driest month and October the wettest month at all three stations.

The warmest month is July and the coldest month is January.

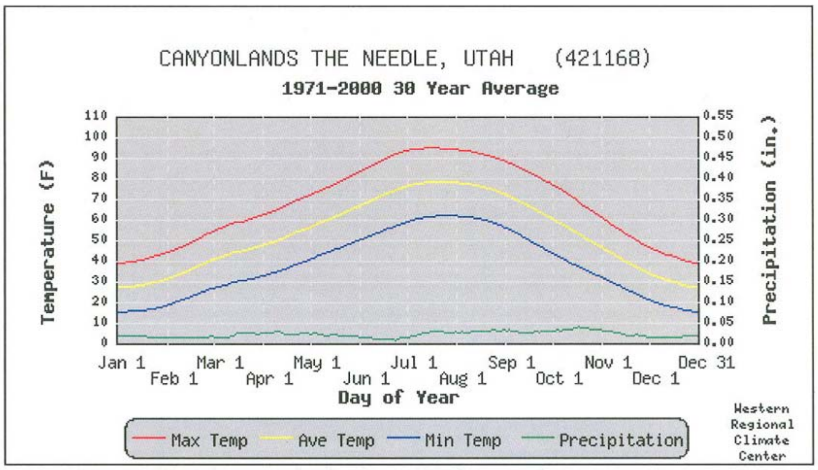
Table 1 gives data on temperature and precipitation for the survey area as recorded at the Needles (fig. 3), the Neck, (fig. 4), and the Arches National Park Headquarters (fig. 5) in the period from 1971 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season. Growing degree days are shown in table 3. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings between the last freeze in spring and the first freeze in fall.

In winter, at the Neck, the average temperature is 31 degrees F and the average daily minimum temperature is 23 degrees F. The lowest temperature on record, which occurred on February 6, 1989, is -13 degrees F. In summer, the average temperature is 76 degrees and the average daily maximum temperature is 88 degrees F. The highest recorded temperature, which occurred on July 15, 2005, is 105 degrees F.

The total annual precipitation is about 9.1 inches. Of this, 4.7 inches, or 51 percent, usually falls in April through September. The growing season for most plants

CANYONLANDS THE NEEDLE, UTAH

1971 - 2000 Temperature and Precipitation



Data is smoothed using a 29 day running average.

- Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
- Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
- Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
- Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

Figure 3.—Temperature and precipitation summary for The Needle weather station in Canyonlands National Park.

falls within this period. In 2 years out of 10, the rainfall in April through September is less than 1.1 inches. The heaviest 1-day rainfall during the period of record was 1.76 inches on April 9, 1978. Thunderstorms occur on about 35 days each year, and most occur in July and August.

The average seasonal snowfall is about 24 inches. The greatest snow depth at any one time during the period of record was 24 inches. On the average, 39 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

In winter, at the Needles, the average temperature is 30 degrees F and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred on January 6, 1971, is -16 degrees. In summer, the average temperature is 75 degrees and the average daily maximum temperature is 90 degrees. The highest recorded temperature, which occurred on July 13, 1971, is 107 degrees.

The total annual precipitation is about 8.4 inches. Of this, 4.3 inches, or 51 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 1.1 inches. The heaviest 1-day rainfall during the period of record was 1.56 inches on September 17, 1999. Thunderstorms occur on about 35 days each year, and most occur in July and August.

The average seasonal snowfall is about 14 inches. The greatest snow depth at any one time during the period of record was 15 inches. On the average, 17 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

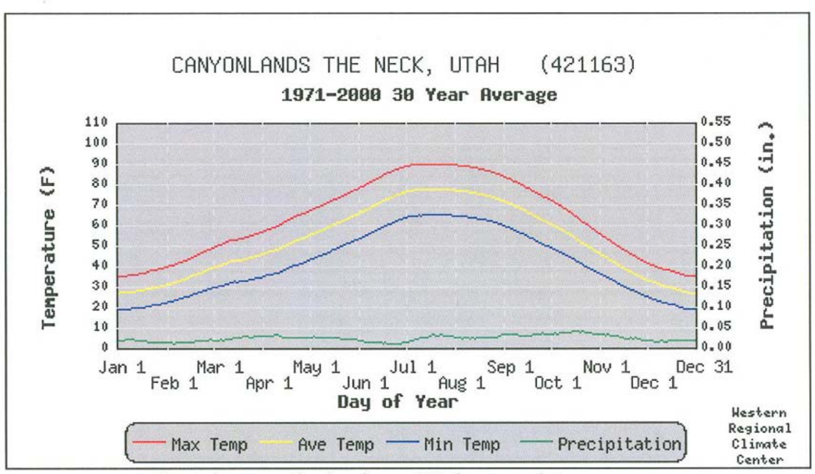
In winter, at the Arches National Park Headquarters, the average temperature is 33 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred on February 6, 1989, is -8 degrees. In summer, the average temperature is 80 degrees and the average daily maximum temperature is 96 degrees. The highest recorded temperature, which occurred on July 13, 2003, is 116 degrees.

The total annual precipitation is about 8.3 inches. Of this, 4.1 inches, or 49 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 1.3 inches. The heaviest 1-day rainfall during the period of record was 1.62 inches on September 8, 2002. Thunderstorms occur on about 35 days each year, and most occur in July and August.

The average seasonal snowfall is about 6 inches. The greatest snow depth at any one time during the period of record was 10 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

CANYONLANDS THE NECK, UTAH

1971 - 2000 Temperature and Precipitation



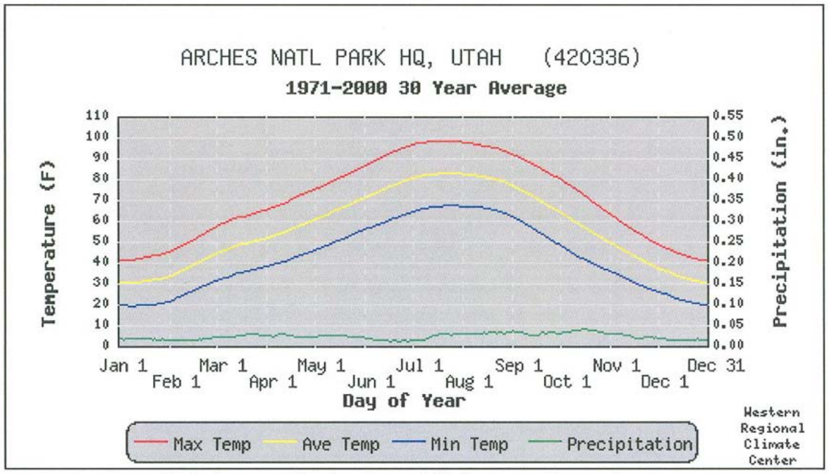
Data is smoothed using a 29 day running average.

- Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
- Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
- Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
- Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

Figure 4. —Temperature and precipitation summary for The Neck weather station in Canyonlands National Park.

ARCHES NATL PARK HQ, UTAH

1971 - 2000 Temperature and Precipitation



Data is smoothed using a 29 day running average.

- Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
- Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
- Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
- Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

Figure 5.—Temperature and precipitation summary for Arches National Park weather station near Canyonlands National Park.

The wind information was estimated from data from the nearby Moab-Canyonlands Airport. Thunderstorm days, relative humidity, and percent sunshine were estimated from the First Order station Grand Junction, Colorado.

The average relative humidity in midafternoon is about 36 percent. Humidity is higher at night, and the average at dawn is about 60 percent. The sun shines 79 percent of the time possible in summer and 62 percent in winter. The prevailing wind is from the west. Average windspeed is highest, 8.7 to 9.2 miles per hour, in April, May, and June.

Vegetation

Canyonlands National Park is within Major Land Resource Area (MLRA) 35–Colorado and Green River Plateau. MLRA 35 occurs in Arizona (56 percent), Utah (22 percent), New Mexico (21 percent), and Colorado (1 percent). It makes up about 71,735 square miles (185,885 square kilometers). The cities of Kingman and Winslow, Arizona; Gallup and Grants, New Mexico; and Kanab and Moab, Utah, are in MLRA 35. National parks and monuments in the Arizona portion of this MLRA include Grand Canyon National Park, Petrified Forest National Park, Canyon de Chelly, and Wupatki National Monument. National parks and monuments in the Utah

portion of this MLRA include Zion National Park, Capitol Reef National Park, Canyonlands National Park, Arches National Park, the Grand Staircase-Escalante National Monument, and Hovenweep National Monument. The Aztec Ruins National Park, El Morro National Park, El Malpais National Park, Chaco Canyon National Monument, and Chaco Culture National Historic Park are in the New Mexico portion of MLRA 35.

Currently in Utah, MLRA 35 is not subdivided by land resource units (LRUs). Most of the area is characterized by horizontal beds of Cretaceous, Jurassic, Triassic, Permian, and Pennsylvanian rocks. The rocks have been eroded into plateaus, mesas, hills, and canyons. In Canyonlands National Park, dominant exposed geologies include the Navajo, Kayenta, and Wingate Sandstones of the Jurassic Period; Chinle and Moenkopi Formations of the Triassic Period; White Rim, Organ Rock, and Cedar Mesa Sandstones, as well as Halgaito Shale, of the Permian Period; and the Honaker Trail and Paradox Formations of the Pennsylvanian Period.

The annual mean precipitation of Canyonlands is approximately 9 inches, but ranges from 5 to 13 inches. Much of the rainfall occurs as convective storms in late summer; about 10 to 30 percent of the total precipitation falls in July and August. Snowpacks are generally light and not persistent throughout the winter. The average annual low temperature is approximately 38 degrees F, and the average annual high temperature is approximately 71 degrees F. The frost-free (<32°F) period averages 170 to 185 days and ranges from 160 to 195 days. The soil temperature regime is mesic, and the soil moisture regimes are ustic aridic and typic aridic.

The dominant plant species on uplands above the canyon rims include twoneedle pinyon, Utah juniper, blackbrush, and mormon tea with an understory of grasses and forbs. Near rock outcrop and on pockets of soil within rock outcrop, the common plants include twoneedle pinyon, Utah juniper, blackbrush, littleleaf mountain mahogany, singleaf ash, Mormon tea, and some perennial grasses and forbs. On hill slopes and steep canyon walls, Utah juniper, singleleaf ash, Fremont’s mahonia, and perennial grasses and forbs are most common. On the low flood-plain steps and riparian corridors within the canyons, the dominant plant species include cottonwood, tamarisk, willows, rabbitbrush and forbs. Intermediate and high flood-plain steps and terraces above the current floodplain often contain an array of plant species such as fourwing saltbush, greasewood, shadscale, sand sagebrush, and a variety of perennial grasses and forbs. Presence or absence of these species is largely dependent on soil characteristics.

Geology

Canyonlands National Park is located on the Colorado Plateau physiographic province within the Canyonlands section in southeastern Utah. The stratigraphic column of exposed rock in Canyonlands National Park begins in the Paleozoic Era in the Pennsylvanian Period and ends in the Mesozoic Era in the Jurassic Period (fig. 6). The top geologic formation exposed in Canyonlands is Glen Canyon Group’s Navajo Sandstone Formation, and the bottommost is the Heromosa Group’s Paradox Formation. All the exposed formations in Canyonlands are the result of sedimentary deposition, both marine and non-marine. Though no igneous or metamorphic rocks are exposed in Canyonlands, faults in Precambrian strata have played a role in shaping Canyonlands by creating zones of weakness, pressure differentials, and movement (Baars, 2003).

Paleozoic Era

During the Paleozoic Era deposits were laid down that would be a key component in creating the landforms of Canyonlands National Park. The Ancestral Rockies

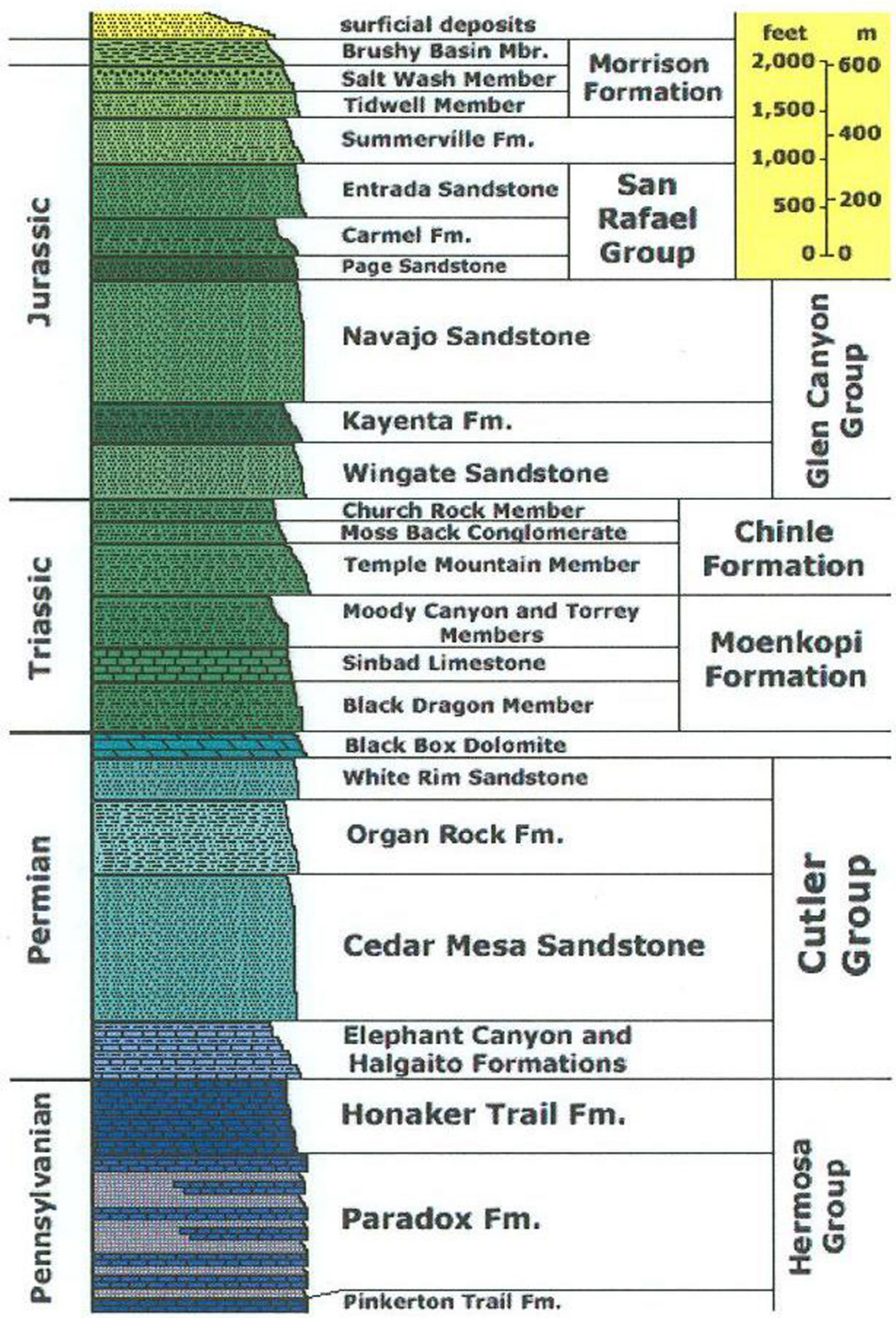


Figure 6.—Geologic period and formation of strata in and around Canyonlands National Park. (USGS, http://3dparks.wr.usgs.gov/coloradoplateau/canyonlands_strat.htm.)

Orogeny formed the Uncompahgre Uplift. While the Uncompahgre Uplift was being formed, the Paradox Basin was created to the south (Stokes, 1986; Baars, 2003). During the Paleozoic Era, particularly in the Pennsylvanian Period, seas covered a large extent of what is present-day Utah. As sea levels fluctuated, the Paradox Basin experienced cycles in which deep marine conditions changed to very shallow water

Figure 7.—Escarpments along the Colorado River composed of Pennsylvanian period geologic formations, observed from The Loop Overlook.

when low sea levels cut off the basin and evaporation occurred. Thick salt deposits laid down during the cycles eventually became layers of black shale, dolomite, anhydrite, halite, potash, and magnesium salts (Stokes, 1986).

Pennsylvanian Period

Formations of the Pennsylvanian Period exposed in Canyonlands National Park include the Paradox Formation, Honaker Trail Formation, and Elephant Canyon Formation (fig. 7). The Paradox Formation consists of Palezoic-era salt deposits, is the oldest exposed rock formation in Canyonlands National Park, and is a key component in the Park's creation. The Grabens in the Needles District provide a clear example of the Paradox Formation's salt deposit influence on the landforms in existence today. The Monument Upwarp resulted in the Colorado River down-cutting and in the extension of brittle formations overlying the Paradox Formation. Down-cutting and exposure of rock strata allowed for the flow of the ductile layer of salt deposits, which resulted in voids below the brittle formations. As salt flowed toward the river and into diapirs, horst blocks subsided, creating the grabens (McGill and Stromquist, 1975; Huntoon, 1982; Baars, 2003; Walsh and Schult-Ela, 2003).

The Honaker Trail Formation is comprised of alternating sandstone, limestone, and siltstone. The sandstone is very fine to fine grained, well to moderately sorted, micaceous, and calcareous (Doelling et al., 2003). Limestone is variably argillaceous; the siltstone is micaceous and is cross-stratified (Doelling et al., 2003). The Honaker Trail Formation is primarily marine in origin, and forms gray cliffs (Baars, 2003). The Elephant Canyon Formation is late Pennsylvanian, although some literature indicates a Permian time. The Elephant Canyon Formation is similar to the limestone beds in the Honaker Trail Formation, as both were laid down during high sea levels.

Permian Period

The Permian Period erosion and deposition processes were controlled by the same features as in the previous Pennsylvanian Period, with the Uncompaghre

Figure 8.—An exposure of Cedar Mesa Formation sandstone in Ernie Country.

Highlands sediments being eroded and fluctuating sea levels depositing marine sediments in the Paradox Basin. Permian-aged formations in Canyonlands National Park include the Cedar Mesa Sandstone (fig. 8), Organ Rock Shale (fig. 9), and White Rim Sandstone (fig. 10).

The Cedar Mesa Sandstone consists of cross-bedded, light-colored, fine-grained, and well-sorted sandstones. The origin of Cedar Mesa Sandstone is a combination of eolian and shallow marine deposition. Parts of the formation exhibit large-scale cross-bedding, indicating eolian processes. Other areas of the formation contain alternating beds, ripples and glauconite grains, indicating marine deposition. Baars (2003) proposed that the Cedar Mesa Sandstone is the result of a coastal accumulation at or near a fluctuating shoreline. The Cedar Mesa Sandstone forms cliffs, domes, and spires. In the Needles District of Canyonlands National Park, the light-colored Cedar Mesa Sandstone is interfingered with the fluvial red beds of the Cutler Formation (Baars, 2003).

The Organ Rock Shale Formation overlies the Cedar Mesa Sandstone. Organ Rock Shale is red in color, and is a soft-weathering cliff-forming unit. The origins of the Organ Rock Shale were in marine lowlands, braided streams, and tidal flats (Stokes, 1986). The Reef series soils often found on Organ Rock Shale reflect the red color of the rock, as well as the loamy textures of the shale.

The White Rim Sandstone Formation lies at the top of the Permian stratigraphic rock sequence. The origins of the White Rim Sandstone were in beach and eolian deposits (Baars and Seager, 1970). White Rim Sandstone is light colored, cross-bedded sandstone that forms cliffs and caprocks around the inner gorge in the Island in the Sky District.

Mesozoic Era

The Mesozoic Era in Canyonlands encompasses the Triassic and Jurassic Periods. The Triassic Period is dominated by fluvial and marine deposition and erosion, whereas the Jurassic Period is dominated by eolian deposition.

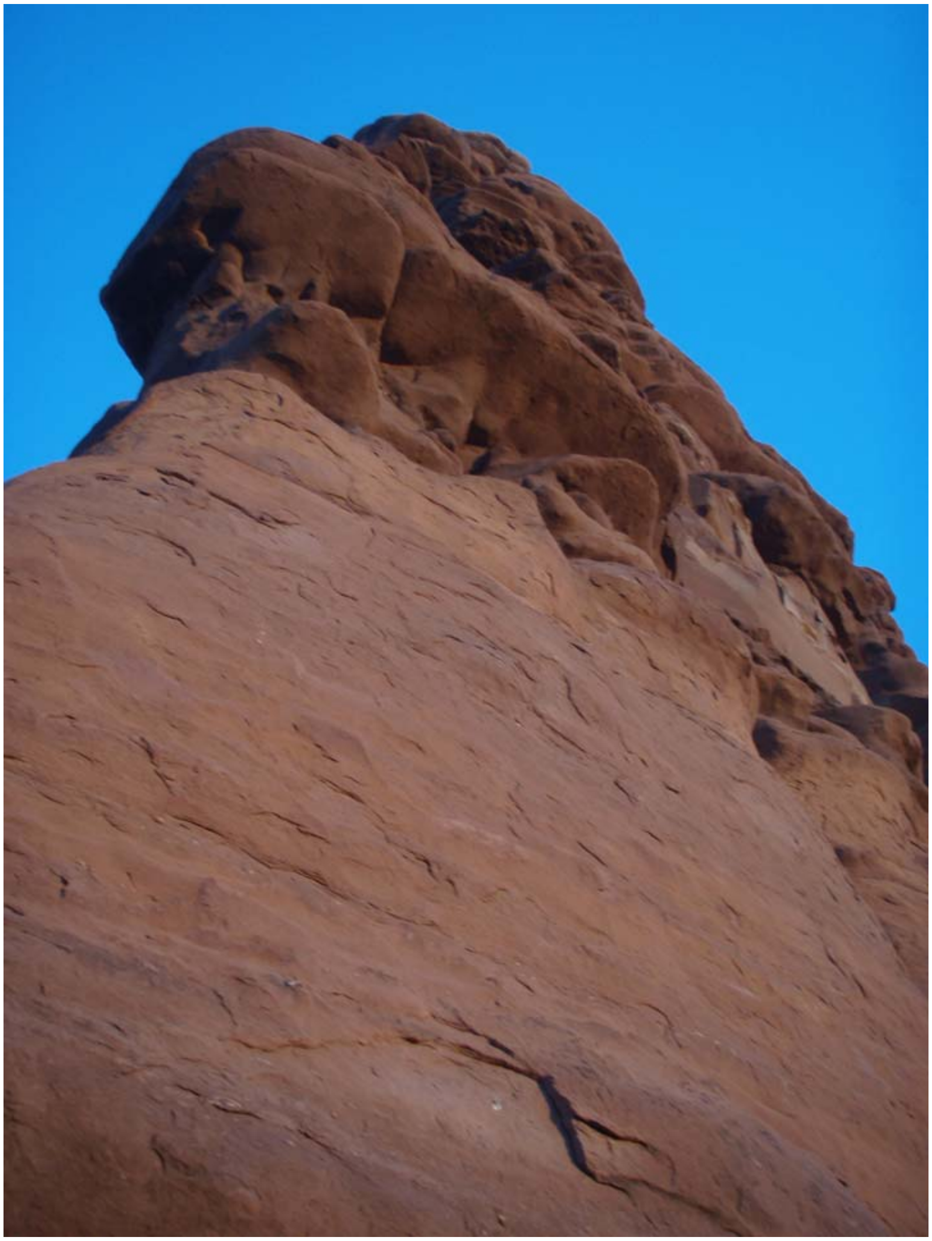


Figure 9. —Standing Rock in The Maze District, a large outcrop of Organ Rock Formation.

Triassic Period

During the early Triassic, shallow seas periodically occupied present-day Utah. Paleography during the late Triassic created an assortment of deposits with origins in rivers, floodplains, swamps, and lakes (Stokes, 1986). Utah during the late Triassic was a semi-enclosed basin, with the Ancestral Rockies to the east and the Cordilleran High to the west. The Ancestral Rockies eroded and filled in the Paradox Basin. Towards the end of the Triassic, significant erosion had taken place during the Uncompahgre Uplift in Utah, and no surface material remained (Stokes, 1986). Formations of the Triassic Period within the Park are the Moenkopi and Chinle.

The Moenkopie Formation (fig. 11) consists of dark red-brown mudstone and siltstone that has characteristics of tidal mud flat deposition, such as small scale ripples, desiccation cracks, and raindrop impressions. The Moenkopi Formation

forms ledges, broad terraces, and slopes with an average thickness of approximately 600 feet (Baars, 2003). The Tsaya family and Moenkopie soils, common on the Moenkopie Formation, have inherited the red color and loamy textures of this fine-grained rock formation.

Figure 10.—An outcrop of White Rim Formation sandstone in The Maze District showing cross-bedding, reflecting the formation's eolian origins.

Figure 11.—Flagstones of Moenkopie Formation sandstone in The Maze District.

Figure 12.—Petrified wood found in the Chinle Formation, western part of The Maze District.

Chinle Formation within the Park is divided into five members. The Moss Back Member delineates the base of the Chinle Formation. The Moss Back Member is a fluvial deposit of sand and gravel with a heterogeneous distribution that forms cliffs and benches. The older Shinarump Conglomerate Member is similar to the Moss Back Member. Both these fluvial members contain significant amounts of uranium within the Park. The mudstone Petrified Forest Member (fig. 12) overlies the Moss Back. Upper members of the Chinle Formation comprise the Black Ledge Member and Church Rock Member. The origins of the upper members consist of tropical streams, lakes, and swamps. The upper members form multi-colored broad slopes of clay with dark brown sandstone ledges.

Jurassic Period

The Jurassic Period represents the youngest rock strata exposed in the Park. The Cordillera of the Jurassic was an influential feature in the formation of the Glen Canyon Group, which includes the Wingate, Kayenta, and Navajo Formations. The cordillera was to the west of Utah and is believed to have created the conditions for sandy deserts by limiting moisture and being a source for fluvial deposits.

The Wingate Formation (fig. 13) of the Jurassic Period overlies the Triassic's Chinle Formation. The Wingate Formation forms brown cliffs, has cross-stratified structure, is eolian in origin, and is 300 to 400 feet thick through most of Canyonlands National Park.

The Kayenta Formation (fig. 14) overlies the Wingate Formation and is a very erosion-resistant fluvial sandstone. Outcrops of the Kayenta Formation exhibit cut-and-fill deposition and form low dark red cliffs and ledges (Baars, 2003). The Rizno soils often associated with the Kayenta Formation are red in color and loamy in texture, similar to the rock formation from which they developed.

The Navajo Formation overlies the Kayenta Formation and forms rounded white

Figure 13.—An exposure of Wingate Formation sandstone.

cliffs. Navajo Sandstone has a high-angle, large-scale cross-stratification structure (fig. 15) with fine to medium grain sizes (Baars, 2003; Beitler, 2003). Navajo Sandstone is the remnant of one of the largest dune fields in the geologic record (Blakey et al., 1998). It is thought that much of the white Navajo Sandstone was once red and contained large amounts of hydrocarbons. During Tertiary uplift and erosion of the Colorado Plateau, hydrocarbons were released and bleached the red sandstone through chemical reduction of iron oxide (Beitler et al., 2003). Using volume and porosity estimates along with bleaching patterns, Beitler and others speculate that Navajo Sandstone was a massive hydrocarbon reservoir. Soils often associated with Navajo sandstone are Nalcase and Pensom, both of which form in eolian sand.

Upheaval Dome

Upheaval Dome is a prominent circular feature in the Island in the Sky District of Canyonlands National Park, and contains deformed and folded formations (fig. 16) of the Permian, Triassic, and Jurassic Periods. It is also a controversial feature. Adding to the difficulty for origin confirmation is the significant uplifting of the Colorado Plateau during the Miocene (Thompson and Zoback, 1979), initiating erosion and removing evidence of Upheaval Dome's origin.

The existence of a salt dome, similar to those in the Gulf of Mexico, is one proposed hypothesis (Mattox, 1975). Others believe Upheaval Dome to be a meteor impact during the late Cretaceous Period (Shoemaker, 1983, 1993). Through a detailed mapping study, a third hypothesis of a pinched-off salt diapir was put forward (Jackson et al., 1998). Jackson argued that the lack of shock metamorphism in quartz grains and synsedimentary structures of Upheaval Dome indicates gradual growth through the Jurassic over at least 20 million years. Recently, Buchner and Kenkmann

Figure 14.—An outcrop of Kayenta Formation sandstone, showing thin layers reflecting the formation's origin in fluvial deposition.

Figure 15.—An exposure of Navajo Formation sandstone showing high-angle cross-bedding, a reminder of the formation's origins in sand dunes.

Figure 16.—Landscape inside Upheaval Dome, showing the contorted and folded geologic strata of this interesting feature in the Island in the Sky District.

(2008) concluded that Upheaval Dome originated from a meteor impact. Buchner and Kenkmann used transmission electron microscopy to examine quartz grains and concluded that the planar deformation or shocked quartz indicates an impact origin.

Quaternary

Quaternary deposits cover a large portion of the Colorado Plateau landscape. Eolian and alluvial deposits are all visible in Canyonlands. Eolian sand deposits have a local and considerable source of material from formations such as the Navajo and Wingate Sandstones. Eolian landforms in Canyonlands take shape as sand sheets and coppice dunes on benches and mesas (fig. 17). Examples of some eolian soils are Nalcase, Arches, and Mido soils. Holocene alluvial deposits of sand, silt, and lenses of gravels underlie fill terraces and inset cut terraces along the Green and Colorado Rivers (Reheis et al., 2005). Biggar and Adams (1987) identified Holocene alluvial deposits in The Grabens through radiocarbon and thermoluminescence techniques.

Soils Overview

All soil development depends on the interaction of five soil-forming factors: parent material, climate, biota (living organisms and their residues), topography, and time. In Canyonlands National Park, the variety of soils that occur across the landscape can be explained by differences in these five factors. One factor of particular importance in the Park is the influence of parent material, or the deposits from which the soils originated. In soils that have relatively little pedogenic development (nearly 70

percent of the identified soils in the park are Entisols), parent material contributes even more to the soil that results (Miller and Donahue, 1990).

Another important factor in the Park is the time during which the materials have been stable in place in order for biota and climate (precipitation and temperature) to affect the parent material. The longer the material has remained stable in place, the more "weathering" of the material may occur, resulting in increased pedogenesis. The rate of weathering depends heavily on available moisture, and in relatively dry environments, such as Canyonlands National Park, it tends to be slow. Topography also influences weathering. On steep slopes, more water runs off the soil surface and less moves down through the soil profile, and thus pedogenesis, or soil development, is slowed. Steep soils also tend to be less stable because of the increased likelihood that parent material will be moved downslope by gravitational forces and slope-wash. Pedogenesis is interrupted whenever the nascent soil slides down the hill or is blown about in strong winds. The factor of time plays a somewhat sporadic role on unstable landforms.

The soils in Canyonlands National Park can be divided into four main categories based on parent material: eolian (wind-blown), alluvial (water-borne), residual (weathered in place), and colluvial soils (transported by gravity).

Eolian soils

Soils of eolian origin are a major constituent of the suite of soils in Canyonlands National Park. These wind-blown materials (mainly fine sands) are highly variable in origin, some coming from many miles away and others being produced very locally, even from the local rock outcrops within the Park. Samples of eolian material in Canyonlands National Park have been dated to 46,000 years ago, with depositional events continuing up to the present day in varying degrees of intensity (Reynolds et

Figure 17.—An area of Quaternary-aged eolian sand deposits.

Figure 18.—A vegetated sand dune.

al., 2006). The variability in these sources can readily be observed in the different colors of sand deposits present throughout the Park.

Eolian soils are found throughout Canyonlands National Park, on any surface that provides adequate stability to the shifting sands for plants to take root. One form that these sand deposits may take is a sand dune. Sand dunes vary in their level of stability. Some dunes are moderately active and sparsely vegetated; other dunes are covered in grasses and shrubs and are relatively more stable (fig. 18). The soils that form on dunes are generally young and either undeveloped or weakly developed. The textures are predominantly fine sand and loamy fine sand throughout. Soil structure is usually weak or nonexistent. The sand grains are commonly loose and non-cemented. An example of this is the Pensom soil in map unit 107.

An ecological site commonly associated with sand dunes is Semidesert Sand (Fourwing Saltbush). Some sandy soils on more stable dunes have developed over time to have a massive or somewhat consolidated soil structure. These soils, such as the Mido soil in map unit 102, commonly have the Semidesert Sand (Blackbrush) ecological site. In shallow soils surrounded by significant amounts of rock outcrop (such as in map unit 114), the ecological site is often Shallow Sand Rock Pocket (Utah Juniper/Pinyon). These pockets benefit from increased available water that results from run-in from the rock outcrop, and often have very diverse plant communities. This ecological site is found on both desert and semidesert soils where the percentage of rock outcrop is very high.

A second group of eolian soils is found in sand sheets. These soils are also of wind-blown origin, but occupy positions of relative stability. The soils found on these broad vegetated sand sheets, although still primarily composed of sand, are usually more “developed” than the dune sands; that is, they have either weak structure, or are massive rather than loose and single-grained. Ecological sites commonly associated with this landscape are Semidesert Sandy Loam (Fourwing Saltbush) and

Semidesert Sand (Fourwing Saltbush). Some soils on the sand sheets have zones of calcium carbonate accumulation, or Bk horizons. While the dunes surrounding them may shift over time and reconfigure their sand grains, these soils in the more stable landscape position of sand sheets remain. These areas may experience episodes of erosion and deposition of sand over time, but a certain amount of more stable soil material remains and continues to weather and develop some level of pedogenesis. An example of this is the Mido soil in map unit 104. This sandy soil has remained in a stable position long enough for there to be been some translocation of calcium carbonate downward through the sands of the profile. The accumulation can be detected by testing for a strong or violent effervescence reaction with cold dilute hydrochloric acid.

A third group of “eolian” soils is found in areas where eolian sands and slope alluvium have intermingled and combined over time into relatively smooth sand sheets (fig. 19). In these areas, the influence of local slope alluvium can be detected by the presence of thin lenses of coarser sands (sometimes with fine gravel included) or finer materials such as silts, interspersed with the usual fine sands of eolian origin. A good example of this is map unit 92, which includes two soils, Mido and Begay, of mixed eolian and slope alluvium origin. Although the Mido soil component is very sandy, it has some structure development indicating a relatively stable soil, rather than the loose sand grains of a more active dune area. The Begay component is even more developed. Begay soils are coarse-loamy rather than sandy, generally have a zone of modest calcium carbonate accumulation, and exhibit a well-developed structure, called a cambic horizon. Cambic horizons exhibit development of structure, color, and somewhat finer texture (loamy fine sand versus fine sandy loam, for example). The soils in these areas of mixed eolian material and slope alluvium have benefited from stability in landscape position, and usually from more vegetation as

Figure 19.—A sand sheet on the mesa of Island in the Sky.

well, which keeps soil in place. Ecological sites commonly associated with this landscape are Semidesert Sandy Loam (Fourwing Saltbush) and Semidesert Sand (Fourwing Saltbush).

Alluvial Soils

Another broad category of soil within the Park is alluvial in nature. The character of these soils depends strongly on two factors: the source material of the alluvium (parent material), and the soil's landscape position relative to intermittent or perennial waterways (topography). The parent material determines the general texture of the soil, sandy versus silty or loamy, as well as other factors, such as salt content. Some alluvial material originated in the smaller watersheds within the Park, while others were transported to the park through waterways that begin far outside the park. In map unit 96 (present along the Green and Colorado Rivers) there are two major soil components: the Green River family soils (fig. 20) on low flood-plain steps, and Bebeevar soils on intermediate flood-plain steps. These soils formed in sediments that originated primarily from the watersheds north of the park. In many of the secondary drainages within the Park, (such as Salt Creek), map unit 99 is present. In this map unit, the Mido family soils dominate on the intermediate flood-plain steps, which are only occasionally flooded. Green River family soils are on the low flood-plain steps and are frequently flooded. In general, the more stable the alluvial landscape on which these soils reside, the more development they may exhibit in terms of structure and color.

A wide variety of ecological sites are associated with alluvial deposits. Alkali Bottom (Greasewood) and Semidesert Sand (Fourwing Saltbush) are often found on stream terraces. Intermediate flood-plain steps often have Loamy Bottom (Basin Big Sagebrush) and Sandy Bottom (Fourwing Saltbush) ecological sites. Low flood-plain steps commonly have the Semiwet Fresh Streambank (Fremont Cottonwood) ecological site.

Residual Soils

Residual soils occur throughout Canyonlands National Park. They are considered to have “weathered in place,” and thus have the same general chemistry as the original rocks. Few soils in Canyonlands National Park are primarily residual; much more commonly, soils may have a minor residual component in the lower portion of their profile. Mellenthin soils in map unit 98 are primarily residual, developed in place from a sandy limestone layer within the Navajo Formation sandstone. They reflect the limestone influence in that Mellenthin soils effervesce strongly in cold hydrochloric acid, and have a high calcium carbonate equivalent content.

Even the most strongly residual soils in the Park, such as the Reef soils in map unit 108, often have a thin skiff of eolian sand at the surface, especially under and around small shrubs.

Ecological sites commonly associated with residual soils include Semidesert Shallow Sandy Loam (Blackbrush) Desert Shallow Sandy Loam (Shadscale), and Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush).

Colluvial Soils

In the Park, colluvium is found primarily on talus slopes and scarp slopes (fig. 21). These colluvial soils result from the falling and tumbling of materials down steep landscapes; the soils accumulate along the sideslopes, especially near the bottoms of the slopes. Wingate and Kayenta Sandstone is the source for the colluvial deposits directly below the mesa of Island in the Sky and in the northern part of the Maze,

Figure 20 —Profile of Green River family soil. The different colored layers are the result of multiple deposition events, typical of soils with alluvial origins. Scale is in centimeters.

below The Spur and above the White Rim (map units 121 and 97). Organ Rock Shale and Moenkopie Sandstone are the source material for many of the soils on scarp slopes above the Land of the Standing Rocks and some areas below the White Rim (map units 109 and 118). The escarpments directly above the Green and Colorado Rivers have areas of colluvial soils derived from Halgaito Shale, Honaker Trail, and Paradox Formations (fig. 22) (map unit 122). The soils that develop from colluvium reflect the characteristics of the parent material; these soils usually have many rocks,

Figure 21.—Colluvium on a steep slope below the Island in the Sky mesa.

ranging from gravels to boulders, throughout the profiles and on the surface. The textures of the soils depend largely upon the geological origin of the colluvial material. Sandstone, such as the Wingate Formation, usually develops into a sandy soil. Soils

Figure 22.—Colluvium on steep slopes above the Colorado River.

developed from the Organ Rock and Moenkopie Sandstones have loamier textures. The textures reflect the differences in the sandstone formation sources.

Ecological sites commonly associated with colluvial landscapes include Desert Very Steep Stony Loam (Shadscale) and Semidesert Very Steep Stony Loam (Pinyon-Utah Juniper)

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape. The approximate percentages of different soils or miscellaneous areas in the different map units was determined using the soil-landscape-landform models developed by extensive ground investigations coupled with remote-sensing tools such as digital elevation models, detailed geology maps, aerial photography, and topographic maps.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-

observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately. Map unit composition (estimates of component percentages) was determined using a combination of transects on the ground, as well as photo interpretation based on ground-truthed data points.

General Soil Map Units

The general soil map in this publication (fig. 23) shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a specific small area or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Alluvial soils on flood plains, terraces, and alluvial flats

1—Water-Green River family-Trail association, nearly level to gently sloping, arid

Map Unit Setting

Landform setting: Flood plains and alluvial plains
Elevation: 3,740 to 4,760 feet (1,140 to 1,452 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 mm)
Slope: 0 to 6 percent

Map Unit Composition

Extent of the association in the survey area: 3 percent
Extent of the components in the association:
Water: 43 percent
Green River family and similar soils: 26 percent
Trail and similar soils: 13 percent

Soils of Minor Extent

Monue soils on stream terraces
Nepalto soils on alluvial flats

Component Descriptions

Water
Position on the landform: Rivers in canyon bottoms

Green River family soils
Position on the landform: Low flood-plain steps
Parent material: Alluvial deposits derived from mixed sources
Depth class: Very deep
Drainage class: Somewhat poorly drained

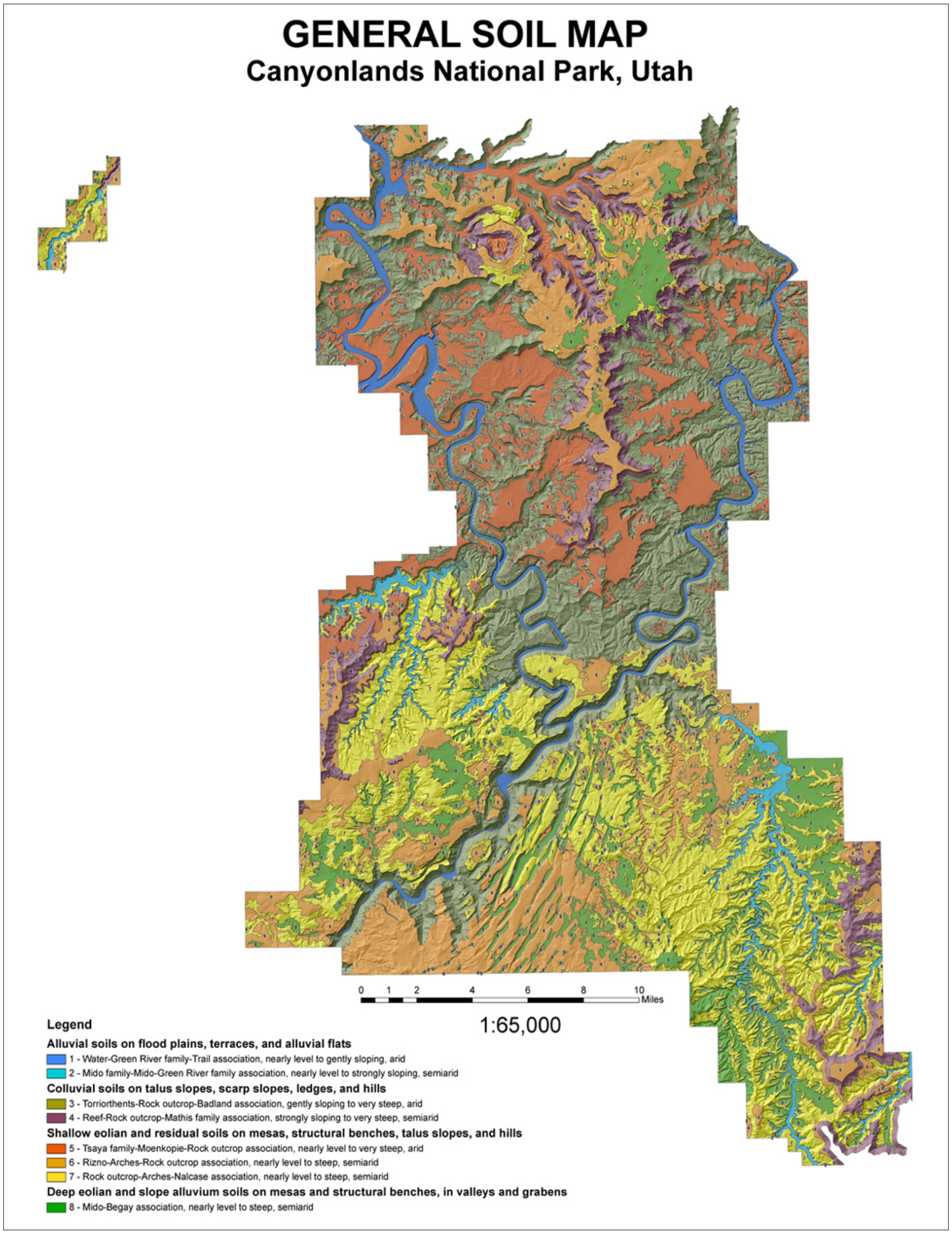


Figure 23.—General Soil Map for Canyonlands National Park.

Permeability: Moderate
Surface texture layer: Silt loam

Trail soils
Position on the landform: Alluvial flats
Parent material: Alluvial deposits derived from sandstone
Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Rapid
Surface texture layer: Loamy fine sand

2—Mido family-Mido-Green River family association, nearly level to strongly sloping, semiarid

Map Unit Setting

Landform setting: Flood plains and terraces
Elevation: 4,180 to 6,230 feet (1,273 to 1,921 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 mm)
Slope: 0 to 15 percent

Map Unit Composition

Extent of the association in the survey area: 2 percent
Extent of the components in the association:
Mido family and similar soils: 47 percent
Mido and similar soils: 27 percent
Green River family and similar soils: 8 percent

Soils of Minor Extent

Rizno soils on structural benches
Riverwash areas with no vegetation
Colluvial soils on canyon sides

Component Descriptions

Mido family soils
Position on the landform: Flood-plain steps and stream terraces
Parent material: Alluvial deposits derived from sandstone
Depth class: Very deep
Drainage class: Excessively drained
Permeability: Very rapid
Surface texture layer: Sand

Mido soils
Position on the landform: Terraces
Parent material: Alluvial and eolian deposits derived from sandstone
Depth class: Very deep
Drainage class: Excessively drained
Permeability: Very rapid
Surface texture layer: Fine sand

Green River soils
Position on the landform: Flood-plain steps
Parent material: Alluvial deposits derived from sandstone

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid
Surface texture layer: Fine sand

Colluvial soils on talus slopes, scarp slopes, ledges, and hills

3—Torriorthents-Rock outcrop-Badland association, gently sloping to very steep, arid

Map Unit Setting

Landform setting: Talus slopes, scarp slopes, and hills
Elevation: 3,740 to 6,400 feet (1,140 to 1,952 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 mm)
Slope: 4 to 70 percent

Map Unit Composition

Extent of the association in the survey area: 26 percent
Extent of the components in the association:
Torriorthents and similar soils: 48 percent
Rock outcrop: 46 percent
Badland: 3 percent

Component Descriptions

Torriorthents soils
Position on the landform: Talus slopes, scarp slopes, and hills
Parent material: Colluvium and residuum derived from sandstone, shale, and limestone
Depth class: Shallow to very deep
Drainage class: Well drained
Permeability: Moderate to moderately rapid
Surface texture layer: Fine sandy loam to very gravelly sandy loam

Rock outcrop
Position on the landform: Talus slopes, structural benches, scarpslopes
Parent material: Wingate, Moenkopie, Cedar Mesa, and Cutler Group Sandstones, Chinle Formation, Halgaito Shale, Honaker Trail, and Paradox Formations

Badland
Position on the landform: Hills
Parent material: Residuum from Chinle Formation Shale and Siltstone

4—Reef-Rock outcrop-Mathis family association, strongly sloping to very steep, semiarid

Map Unit Setting

Landform setting: Talus slopes and ledges

Elevation: 4,310 to 7,190 feet (1,314 to 2,191 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 mm)
Slope: 15 to 70 percent

Map Unit Composition

Extent of the association in the survey area: 6 percent
Extent of the components in the association:
Reef and similar soils: 30 percent
Rock outcrop: 27 percent
Mathis family and similar soils: 24 percent

Soils of Minor Extent

Rizno soils on talus slopes, ledges, and structural benches

Component Descriptions

Reef soils
Position on the landform: Talus slopes
Parent material: Colluvium derived from sandstone
Depth class: Shallow
Drainage class: Somewhat excessively drained
Permeability: Moderate
Surface texture layer: Very channery loam

Rock outcrop
Position on the landform: Talus slopes
Parent material: Moenkopie Sandstone and Organ Rock Shale

Mathis family soils
Position on the landform: Talus slopes
Parent material: Colluvium derived from sandstone
Depth class: Moderately deep to very deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Surface texture layer: Very stony loamy sand

Shallow eolian and residual soils on mesas, structural benches, talus slopes, and hills

5—Tsaya family-Moenkopie-Rock outcrop association, nearly level to very steep, arid

Map Unit Setting

Landform setting: Structural benches, hills, and talus slopes
Elevation: 3,910 to 5,370 feet (1,192 to 1,637 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 mm)
Slope: 2 to 80 percent

Map Unit Composition

Extent of the association in the survey area: 12 percent
Extent of the components in the association:

Tsaya family and similar soils: 37 percent
Moenkopie and similar soils: 28 percent
Rock outcrop: 9 percent

Soils of Minor Extent

Needle soils on structural benches
Bluechief soils on structural benches
Goblin soils on hills
Sheppard family soils on structural benches

Component Descriptions

Tsaya family soils
Position on the landform: Hills, structural benches, and talus slopes
Parent material: Residuum, colluvium, and slope alluvium derived from sandstone
Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately rapid
Surface texture layer: Fine sandy loam, sandy loam, and very gravelly sandy loam

Moenkopie soils
Position on the landform: Hills and structural benches
Parent material: Residuum and slope alluvium derived from sandstone
Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately rapid
Surface texture layer: Loamy sand

Rock outcrop
Position on the landform: Hills and structural benches
Parent material: Moenkopie, White Rim, Organ Rock, and Cutler Group Sandstones, and Chinle Formation

6—Rizno-Arches-Rock outcrop association, nearly level to steep, semiarid

Map Unit Setting

Landform setting: Mesas and structural benches
Elevation: 4,360 to 6,990 feet (1,330 to 2,131 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 mm)
Slope: 2 to 60 percent

Map Unit Composition

Extent of the association in the survey area: 17 percent
Extent of the components in the association:
Rizno and similar soils: 35 percent
Arches and similar soils: 18 percent
Rock outcrop: 14 percent

Soils of Minor Extent

Mellenthin soils on mesas
Reef soils on mesas

Sazi soils on mesas and structural benches
Mido soils on mesas and structural benches

Component Descriptions

Rizno soils
Position on the landform: Mesas and structural benches
Parent material: Residuum and eolian deposits derived from sandstone
Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately rapid
Surface texture layer: Very fine sand to gravelly sandy loam

Arches soils
Position on the landform: Mesas and structural benches
Parent material: Eolian deposits derived from sandstone
Depth class: Shallow
Drainage class: Somewhat excessively drained
Permeability: Rapid
Surface texture layer: Fine sand

Rock outcrop
Position on the landform: Mesas and structural benches
Parent material: Kayenta, Navajo, and Cedar Mesa Sandstones, and Organ Rock Shale

7—Rock outcrop-Arches-Nalcase association, nearly level to steep, semiarid

Map Unit Setting

Landform setting: Mesas, structural benches, and buttes
Elevation: 4,250 to 6,840 feet (1,294 to 2,084 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 mm)
Slope: 2 to 60 percent

Map Unit Composition

Extent of the association in the survey area: 24 percent
Extent of the components in the association:
Rock outcrop: 74 percent
Arches and similar soils: 17 percent
Nalcase and similar soils: 1 percent

Soils of Minor Extent

Rizno soils on mesas and structural benches
Mido soils on mesas and structural benches
Reef soils on steep slopes
Sazi soils on mesas and structural benches

Component Descriptions

Rock outcrop
Position on the landform: Mesas, structural benches, and buttes
Parent material: Navajo and Cedar Mesa Sandstones, and Cutler Undifferentiated Group

Arches soils
Position on the landform: Mesas, structural benches, and buttes
Parent material: Eolian deposits derived from sandstone
Depth class: Shallow
Drainage class: Somewhat excessively drained
Permeability: Rapid
Surface texture layer: Fine sand and loamy fine sand

Nalcase soils
Position on the landform: Mesas, structural benches, and buttes
Parent material: Eolian deposits derived from sandstone
Depth class: Shallow
Drainage class: Somewhat excessively drained
Permeability: Very rapid
Surface texture layer: Fine sand

Deep eolian and slope alluvium soils on mesas and structural benches, in valleys and grabens

8—Mido-Begay association, nearly level to steep, semiarid

Map Unit Setting

Landform setting: Mesas, valleys, structural benches, and grabens
Elevation: 4,370 to 6,650 feet (1,333 to 2,028 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 mm)
Slope: 0 to 30 percent

Map Unit Composition

Extent of the association in the survey area: 10 percent
Extent of the components in the association:
Mido and similar soils: 54 percent
Begay and similar soils: 17 percent

Soils of Minor Extent

Ignacio soils on mesas and structural benches
Pensom soils on mesas and structural benches
Arches soils on mesas and structural benches
Sazi soils on mesas and structural benches
Rock outcrop
Batterson soils on mesas and structural benches

Component Descriptions

Mido soils
Position on the landform: Mesas, structural benches, valleys, and grabens
Parent material: Eolian deposits and slope alluvium derived from sandstone
Depth class: Very deep
Drainage class: Excessively drained

Permeability: Rapid
Surface texture layer: Fine sand and loamy fine sand

Begay soils
Position on the landform: Mesas, structural benches, and valleys
Parent material: Eolian deposits and slope alluvium derived from sandstone
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Surface texture layer: Loamy fine sand to loam

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils. Table 4 shows the taxonomic classification for each soil in the survey area.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

An effort was made to map the detailed soil map units across the boundary between Canyonlands National Park and the Orange Cliffs Section of the Glen Canyon National Recreation Area. For this reason, those shared detailed soil map unit descriptions include not only the ranges in characteristics of the soils within the

Canyonlands boundary, but also those characteristics found in the Orange Cliffs Section.

Soils that have profiles that are almost alike make up a soil *series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

A soil series *family* has properties that are slightly outside the official series range but is in the same taxonomic classification as the official series. An example is Mido family, sodic, 0 to 8 percent slopes.

Taxadjuncts are soils that have properties outside the range of any recognized series, and are given the name of an established series that is most similar in characteristics. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named. The differences in properties are small so that major interpretations are not affected. An example is Goblin very gravelly sandy loam, 6 to 45 percent slopes. Goblin is identified as a taxadjunct in table 4.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Mido fine sand, 2 to 15 percent slopes, is a phase of the Mido series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Rock outcrop-Arches complex, 2 to 60 percent slopes, is an example.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Soil Descriptions

90—Arches-Rock outcrop complex, 2 to 15 percent slopes

Map Unit Setting

General setting: Island in the Sky and Horseshoe Canyon Districts, Canyonlands National Park (fig. 24)
Elevation: 4,840 to 6,330 feet (1,474 to 1,928 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Arches and similar soils: 65 percent
Rock outcrop, Navajo Formation sandstone: 15 percent
Minor Components:
- Wayneco taxadjunct soils–Semidesert Shallow Sandy Loam (Blackbrush)

Figure 24. — Landscape of map unit 90 (Arches-Rock outcrop complex, 2 to 15 percent slopes) in the Island in the Sky District.

- Other shallow soils in areas with greater percentage of rock outcrop–Shallow Sand Rock Pocket (Utah Juniper)
- Sazi soils–Semidesert Sandy Loam (Blackbrush)

Soil Properties and Qualities

Arches soils

Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 25)
Landform: Mesas
Geology: Navajo Formation sandstone (Jurassic)
Parent material: eolian sands derived from sandstone
Slope: 2 to 15 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	3-8
Rock Fragments:	0-5
Bare Soil:	8-12
Cyanobacteria Crust:	1-10
Lichen Crust:	40-50
Moss Crust:	1-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 0.5 (very low)
Shrink-swell potential: about 1.5 LEP (low)

Figure 25.— Soil profile of Arches soil in map unit 90 (Arches-Rock outcrop complex, 2 to 15 percent slopes). Lithic contact is at 27 centimeters. Scale is in centimeters.

Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): blackbrush, Utah juniper, twoneedle pinyon, broom snakeweed, Indian ricegrass
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
599,490 meters E, 4247,581 meters N, zone 12.

A—0 to 1 inch (0 to 3 cm); reddish brown (2.5YR 5/3) fine sand, reddish brown (2.5YR 4/3), moist; 1 percent clay; weak medium granular and weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots throughout; many very fine interstitial pores; very slightly effervescent, 2 percent calcium carbonate equivalent; slightly alkaline, pH 7.8; clear wavy boundary.

Bw1—1 to 4.5 inches (3 to 11 cm); reddish brown (2.5YR 5/4) fine sand, reddish brown (2.5YR 4/4), moist; 2 percent clay; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots throughout; common very fine interstitial pores; very slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

Bw2—4.5 to 9 inches (11 to 23 cm); reddish brown (2.5YR 4/4) fine sand, dark reddish brown (2.5YR 3/4), moist; 2 percent clay; moderate medium parting to weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots throughout; common very fine interstitial pores; slightly effervescent, 3 percent calcium carbonate equivalent; strongly alkaline, pH 8.4; abrupt wavy boundary.

2R—9 to 19 inches (23 to 48 cm); few fine roots throughout; hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 2.5YR, 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 to 8, dry or moist
Texture: very fine sand, fine sand, loamy fine sand
Clay content: 1 to 6 percent
Calcium carbonate equivalent: 0 to 3 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw horizons
Hue: 2.5YR, 5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 4 to 8, dry or moist
Texture: very fine sand, fine sand, loamy fine sand
Clay content: 1 to 6 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

Rock outcrop, Navajo Formation sandstone
This component is characterized by nearly level to gently sloping rock outcrop. The lithology is sandstone. Slopes generally range from 2 to 30 percent. Typically, there are very few cliffs or escarpments to impede travel. The vertical relief is usually less than a few feet. The area can usually be easily negotiated by four-wheeled vehicles. There are no impediments to foot travel or to the movement of animals. The area is typically barren but may have vegetation growing in cracks and crevices or in thin layers of sediment covering the surface. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

91—Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Maze and The Needles Districts, Canyonlands National Park
Elevation: 4,360 to 6,860 feet (1,330 to 2,090 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)

Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Arches, sand sheet and similar soils: 30 percent
Mido and similar soils: 30 percent
Rock outcrop, Cedar Mesa Sandstone: 20 percent
Minor Components:

- Rizno soils–Semidesert Shallow Sandy Loam (Utah Juniper-Pinyon)
- Sazi soils–Semidesert Sandy Loam (Utah Juniper/Blackbrush)
- Soils on steep slopes–Semidesert Very Steep Stony Loam (Utah Juniper/Pinyon)

Soil Properties and Qualities

Arches, sand sheet soils
Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 26)
Landform: Structural benches (fig. 27)
Geology: Eolian Sand (Quaternary), Cedar Mesa and White Rim Formation sandstones (Permian)
Parent material: eolian sands
Slope: 2 to 6 percent, southeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-45
Litter <5mm:	3-8
Rock Fragments:	3-8
Bare Soil:	15-25
Cyanobacteria Crust:	5-10
Lichen Crust:	25-30
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 17 inches to bedrock, paralithic; 4 to 20 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 0.4 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): blackbrush, Utah juniper, broom snakeweed, pinyon, fourwing saltbush, galleta
Land capability (non irrigated): 7s

Figure 26.—Profile of Arches soil in map unit 91 (Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes). Paralithic contact is at 18 centimeters, lithic contact at 25 centimeters. Scale is in centimeters.

Figure 27.—Landscape of Arches soil component in map unit 91 (Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes). Biological crust is often robust in this map unit, as seen in this photo.

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
584,650 meters E, 4223,488 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; weak very thick platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine interstitial pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.

C—4.5 to 7 inches (11 to 18 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine interstitial pores; 5 percent channers; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.

2Cr—7 to 10 inches (18 to 25 cm); few fine roots in cracks; soft Cedar Mesa Formation sandstone bedrock; abrupt smooth boundary.

2R—10 to 19.5 inches (25 to 50 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
- Value: 5 or 6 dry, 4 or 5 moist
- Chroma: 4 to 6, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 2 to 8 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: 0 to 5 percent fine gravel

C horizon
- Hue: 5YR, 7.5YR
- Value: 5 to 7 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 1 to 7 percent
- Calcium carbonate equivalent: 0 to 10 percent
- Rock fragments: 0 to 5 percent gravel
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Mido soils

Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 28)
Landform: Dunes on structural benches (fig. 29)
Geology: Sand Deposits (Quaternary)
Parent material: eolian sands
Slope: 5 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	5-10
Rock Fragments:	0-5
Bare Soil:	20-30
Cyanobacteria Crust:	3-8
Lichen Crust:	3-8
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Figure 28.—Profile of Mido soil in map unit 91 (Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes). Scale is in centimeters.

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 3.6 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 10 percent

Figure 29.—Landscape of Mido soil component in map unit 91 (Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes).

Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Blackbrush)
Ecological site number: R035XY210UT
Present vegetation (in most areas): blackbrush, Utah juniper, broom snakeweed, fourwing saltbush, pinyon, galleta
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
584,555 meters E, 4223,584 meters N, zone 12.

A—0 to 1.5 inches (0 to 4 cm); reddish yellow (7.5YR 6/6) sand, dark brown (7.5YR 3/3), moist; 2 percent clay; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots throughout; many very fine interstitial pores; noneffervescent, 0 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

C1—1.5 to 23 inches (4 to 59 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common very fine, fine and medium roots throughout; many very fine interstitial pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

C2—23 to 57 inches (59 to 145 cm); reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6), moist; 2 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, common fine, and few medium roots throughout; common very fine interstitial pores; strongly effervescent, 4 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

2C3—57 to 60 inches (145 to 153 cm); yellowish red (5YR 5/6) sand, yellowish red (5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; few very fine roots throughout; common very fine interstitial pores; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

2Cr—60 to 70 inches (153 to 178 cm); soft Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 5 to 7 dry, 3 to 6 moist
- Chroma: 3 to 6, dry or moist
- Texture: sand, fine sand, loamy fine sand
- Clay content: 1 to 6 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: 0 to 10 percent gravel
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

C horizons
- Hue: 5YR, 7.5YR
- Value: 4 to 6, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 1 to 5 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: none
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

2C horizon
- Value: 5 to 7, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: sand, fine sand, loamy coarse sand
- Clay content: 2 to 5 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 0 to 10 percent gravel, 0 to 30 percent paragravel
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Rock outcrop, Cedar Mesa Formation sandstone

This component is characterized by gently sloping to steep rock outcrop. The lithology is sandstone. Slopes generally range from 2 to 45 percent. Typically, there are very few, nearly vertical cliffs to impede vehicular travel. The vertical relief is usually a few feet to several feet. Because of the steepness of slopes, the area can be negotiated by full-sized four-wheeled vehicles with care. There are no impediments to foot travel or to the movement of animals. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

92—Begay, bedrock substratum-Mido complex, 2 to 6 percent slopes

Map Unit Setting

General setting: Island in the Sky and The Maze Districts, Canyonlands National Park (fig. 30)
Elevation: 4,920 to 6,370 feet (1,499 to 1,942 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Begay, bedrock substratum and similar soils: 50 percent
Mido and similar soils: 40 percent
Minor Components:
- Sazi soils–Semidesert Sandy Loam (Blackbrush)
- Earlweed soils–Semidesert Sand (Fourwing Saltbush)
- Mivida soils–Semidesert Sandy Loam (Fourwing Saltbush)

Soil Properties and Qualities

Begay, bedrock substratum soils
Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids (fig. 31)
Landform: Sand sheets on mesas, sand sheets on structural benches
Geology: Eolian sand and slope alluvium (Quaternary)

Figure 30.—Landscape of map unit 92 (Begay, bedrock substratum-Mido complex, 2 to 6 percent slopes) on the mesa of Island in the Sky.

Figure 31.— Profile of Begay, bedrock substratum soil in map unit 92 (Begay, bedrock substratum-Mido complex, 2 to 6 percent slopes). Hard bedrock (not visible) is at 165 centimeters. Scale is in centimeters.

Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 6 percent, northeast to west aspects

Ground Cover:	(% Cover)
Plant Canopy:	60-70
Litter <5mm:	1-8
Rock Fragments:	0-2
Bare Soil:	10-15
Cyanobacteria Crust:	5-15
Lichen Crust:	0-5
Moss Crust:	0-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: well drained

Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 8.7 (high)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: low
Hydrologic group: A
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Semidesert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY215UT
Present vegetation (in most areas): needle and thread, Indian ricegrass, broom snakeweed, blue grama, fourwing saltbush, Cutler Mormon tea, plains pricklypear, gilia
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator): 603,518 meters E, 4259,008 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm) brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4), moist; 10 percent clay; weak very thick platy and weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine and common fine roots throughout; common fine irregular pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt smooth boundary.

Bw1—3.5 to 6 inches (9 to 15 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 10 percent clay; moderate very thick platy structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common fine irregular pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear smooth boundary.

Bw2—6 to 15.5 inches (15 to 40 cm); yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6), moist; 12 percent clay; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and common fine roots throughout; common fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear smooth boundary.

Bk1—15.5 to 31.5 inches (40 to 80 cm); light brown (7.5YR 6/4) fine sandy loam, strong brown (7.5YR 4/6), moist; 11 percent clay; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common fine irregular pores; common medium irregular carbonate masses in matrix; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Bk2—31.5 to 61 inches (80 to 155 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 10 percent clay; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common medium irregular carbonate masses in matrix; strongly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline; abrupt wavy boundary.

2R—61 to 71 inches (155 to 180 cm); hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: loamy fine sand, loamy sand, fine sandy loam
- Clay content: 3 to 10 percent
- Calcium carbonate equivalent: 0 to 3 percent
- Rock fragments: none
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5, dry or moist
- Texture: loamy fine sand, fine sandy loam, very fine sandy loam
- Clay content: 4 to 15 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: 0 to 5 percent gravel

Bk horizon
- Hue: 5YR, 7.5YR
- Value: 5 to 7 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sandy loam, very fine sandy loam
- Clay content: 10 to 15 percent
- Calcium carbonate equivalent: 2 to 10 percent
- Rock fragments: 0 to 10 percent gravel
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Some pedons have thin 2BCk or 2C horizons below 50 inches.

Soil reaction is generally higher in pedons in The Maze District because of the influence of Cedar Mesa Sandstone.

Mido soils

Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 32)
Landform: Sand sheets on mesas, sand sheets on mesas
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 6 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	70-80
Litter <5mm:	1-5
Rock Fragments:	0-2
Bare Soil:	5-10
Cyanobacteria Crust:	0-10
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained

Figure 32.—Profile of Mido soil in map unit 92 (Begay, bedrock substratum-Mido complex, 2 to 6 percent slopes). Scale is in centimeters.

Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 6.9 (moderate)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)
Ecological site number: R035XY212UT

Present vegetation (in most areas): needle and thread, Indian ricegrass, blue grama, fourwing saltbush, broom snakeweed, Cutler Mormon tea
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
602,305 meters E, 4253,222 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); yellowish red (5YR 5/6) fine sand, reddish brown (5YR 4/4), moist; 1 percent clay; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine irregular pores; noneffervescent, 0 percent calcium carbonate equivalent; slightly alkaline, pH 7.8; abrupt smooth boundary.
Bw—4.5 to 8 inches (11 to 20 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine irregular pores; noneffervescent, 1 percent calcium carbonate equivalent; slightly alkaline, pH 7.8; gradual wavy boundary.
C1—8 to 51 inches (20 to 130 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; many very fine interstitial pores; 1 percent gravel; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; gradual wavy boundary.
C2—51 to 78.5 inches (130 to 200 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; many very fine interstitial pores; strongly effervescent, 4 percent calcium carbonate equivalent; moderately alkaline, pH 8.2.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Texture: fine sand, loamy fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 0 to 2 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw horizon
Hue: 5YR, 7.5YR
Chroma: 4 or 6, dry or moist
Texture: fine sand, loamy fine sand
Clay content: 1 to 8 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

C horizon
Hue: 5YR, 7.5YR
Chroma: 4 or 6, dry or moist
Texture: loamy fine sand, fine sand
Clay content: 1 to 5 percent

Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 2 percent gravel

93—Begay-Ignacio complex, 2 to 10 percent slopes

Map Unit Setting

General setting: Island in the Sky District, Canyonlands National Park (fig. 33)
Elevation: 5,000 to 6,250 feet (1,524 to 1,904 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Begay and similar soils: 50 percent
Ignacio and similar soils: 30 percent
Minor Components:
- Rock outcrop (Navajo Formation sandstone)
- Moderately deep soils with argillic horizons–Semidesert Sandy Loam (Fourwing Saltbush)
- Arches soils–Semidesert Shallow Sandy Loam (Utah Juniper/Blackbrush)

Figure 33.—Landscape of map unit 93 (Begay-Ignacio complex, 2 to 10 percent slopes) on the mesa of Island in the Sky.

Figure 34.—Profile of Begay soil in map unit 93 (Begay-Ignacio complex, 2 to 10 percent slopes). Scale is in centimeters.

Soil Properties and Qualities

Begay soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids (fig. 34)
Landform: Sand sheets on mesas
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 10 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	45-55
Litter <5mm:	5-10
Rock Fragments:	0-5
Bare Soil:	3-8
Cyanobacteria Crust:	20-25
Lichen Crust:	5-10

Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 10.2 (very high)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: low
Hydrologic group: A
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY215UT
Present vegetation (in most areas): needle and thread, Indian ricegrass, blue grama, sandhill muhly, Cutler Mormon tea, fourwing saltbush
Land capability (non irrigated): 6e

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
600,728 meters E, 4251,757 meters N, zone 12.

A—0 to 4 inches (0 to 10 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 5 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots throughout; many very fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; slightly alkaline, pH 7.8; abrupt smooth boundary.

BA—4 to 15.5 inches (10 to 40 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 5 percent clay; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and few fine roots throughout; common very fine tubular pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear wavy boundary.

Bw—15.5 to 59 inches (40 to 150 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 10 percent clay; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine tubular pores; few medium irregular carbonate masses in matrix; strongly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C—59 to 78.5 inches (150 to 200 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 9 percent clay; single grain; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots throughout; common very fine interstitial pores; slightly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 to 7, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: loamy fine sand, fine sandy loam
- Clay content: 5 to 10 percent
- Calcium carbonate equivalent: 0 to 2 percent
- Rock fragments: none
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw horizon
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: loamy fine sand, fine sandy loam
- Clay content: 5 to 15 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: none

Bk horizon (where present)
- Value: 5 or 6 dry, 4 or 5 moist
- Texture: fine sandy loam, loamy fine sand
- Clay content: 8 to 15 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: none

C horizon
- Value: 4 or 5, dry or moist
- Texture: fine sandy loam, loamy fine sand
- Clay content: 5 to 10 percent
- Calcium carbonate equivalent: 1 to 10 percent
- Rock fragments: none

Ignacio soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids (fig. 35)
Landform: Sand sheets on mesas
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 8 percent, northeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	45-55
Litter <5mm:	10-15
Rock Fragments:	0-5
Bare Soil:	0-5
Cyanobacteria Crust:	20-25
Lichen Crust:	5-10
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Figure 35.—Profile of Ignacio soil in map unit 93 (Begay-Ignacio complex, 2 to 10 percent slopes). Lithic contact (not visible) is at 56 centimeters. Scale is in centimeters.

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 3.1 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: high
Hydrologic group: C
Calcium carbonate maximum: about 15 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Semidesert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY215UT

Present vegetation (in most areas): needle and thread, Indian ricegrass, blue grama, Cutler Mormon tea, fourwing saltbush
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
602,364 meters E, 4253,745 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/4), moist; 14 percent clay; moderate medium platy and moderate fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine and fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; slightly alkaline, pH 7.4; very abrupt smooth boundary.
Bw—4.5 to 17.5 inches (11 to 44 cm); strong brown (7.5YR 5/6) fine sandy loam, strong brown (7.5YR 4/6), moist; 12 percent clay; moderate coarse parting to moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and nonplastic; common fine and medium roots throughout; many very fine and fine vesicular pores; very slightly effervescent, 1 percent calcium carbonate equivalent; slightly alkaline, pH 7.4; clear smooth boundary.
Bk—17.5 to 22 inches (44 to 56 cm); reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 4/6), moist; 15 percent clay; moderate medium angular parting to moderate fine subangular blocky structure; moderately hard, friable, slightly sticky and nonplastic; common fine roots throughout; common very fine and fine vesicular pores; carbonate, finely disseminated in matrix and common fine irregular carbonate nodules in matrix; violently effervescent, 8 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.
2R—22 to 34.5 inches (56 to 87 cm); hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 3 to 5, dry or moist
Chroma: 4 to 6, dry or moist
Texture: fine sandy loam, loamy fine sand, fine sand
Clay content: 3 to 15 percent
Calcium carbonate equivalent: 0 to 2 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 6 or 8, dry or moist
Clay content: 10 to 15 percent
Calcium carbonate equivalent: 1 to 10 percent
Rock fragments: 0 to 5 percent gravel
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bk horizon
Hue: 5YR, 7.5YR
Value: 4 to 6, dry or moist
Texture: fine sandy loam, loamy fine sand

Clay content: 5 to 15 percent
Calcium carbonate equivalent: 5 to 15 percent
Rock fragments: 0 to 30 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

94—Bluechief-Needle complex, 2 to 15 percent slopes

Map Unit Setting

General setting: White Rim region of The Maze and Island in the Sky Districts, Canyonlands National Park
Elevation: 3,980 to 5,250 feet (1,213 to 1,599 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Bluechief and similar soils: 45 percent
Needle and similar soils: 40 percent
Minor Components:
- Moenkopie soils–Desert Shallow Sandy Loam (Shadscale)
- Sheppard soils–Desert Sandy loam (Blackbrush) and Desert Sand (Fourwing)

Soil Properties and Qualities

Bluechief soils
Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Typic Haplocalcids (fig. 36)
Landform: Structural benches (fig. 37)
Geology: Eolian Sand (Quaternary) and White Rim Formation Sandstone (Permian)
Parent material: eolian deposits derived from sandstone and/or residuum weathered from sandstone
Slope: 2 to 8 percent, northeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	20-40
Litter <5mm:	10-20
Rock Fragments:	0-10
Bare Soil:	0-15
Cyanobacteria Crust:	30-50
Lichen Crust:	0-10
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 4.5 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: high

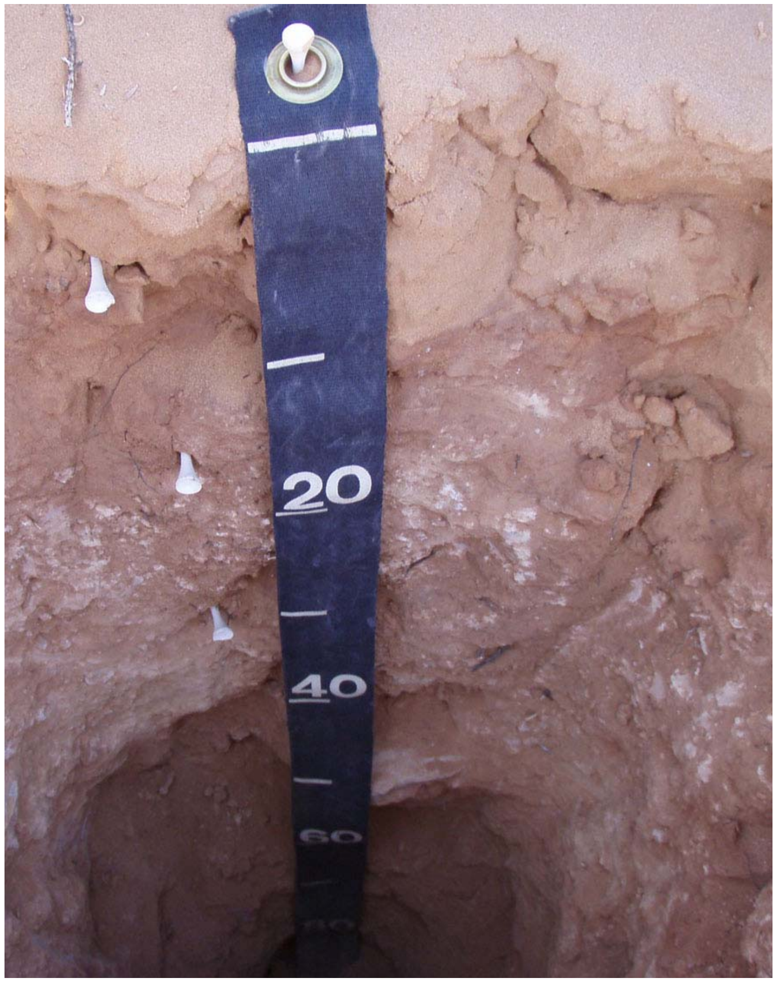


Figure 36.—Profile of Bluechief soil in map unit 94 (Bluechief-Needle complex, 2 to 15 percent slopes). Calcic horizon starts at 17 centimeters, lithic contact (not visible) is at 87 centimeters. Scale is in centimeters.

Hydrologic group: B
Calcium carbonate maximum: about 35 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Desert Sandy Loam (Blackbrush)
Ecological site number: R035XY121UT
Present vegetation (in most areas): blackbrush, Indian ricegrass, galleta, Torrey Mormon tea
Land capability (non irrigated): 7e

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
594,852 meters E, 4246,840 meters N, zone 12.

A—0 to 2.5 inches (0 to 6 cm); reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6), moist; 2 percent clay; weak fine subangular blocky structure; soft, very

Figure 37.—Landscape of Bluechief component in map unit 94 (Bluechief-Needle complex, 2 to 15 percent slopes).

friable, nonsticky and nonplastic; common very fine roots throughout; many very fine interstitial pores; very slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

Bw—2.5 to 6.5 inches (6 to 17 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 6 percent clay; moderate medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; 2 percent fine gravel; strongly effervescent, 4 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

Bk1—6.5 to 13.5 inches (17 to 34 cm); reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 5/8), moist; 13 percent clay; moderate fine and medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common very fine irregular pores; common prominent irregular carbonate masses in matrix; 8 percent fine gravel; violently effervescent, 12 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Bk2—13.5 to 34.5 inches (34 to 87 cm); reddish yellow (5YR 6/6) gravelly fine sandy loam, reddish yellow (5YR 6/8), moist; 15 percent clay; moderate fine and medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common very fine irregular pores; many prominent irregular carbonate masses in matrix; 20 percent fine gravel; violently effervescent, 28 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

2R—34.5 to 44 inches (87 to 112 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

A horizon
- Value: 4 to 6, dry or moist
- Chroma: 4 to 6, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 2 to 8 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 5 percent gravel

Bw horizon
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Clay content: 5 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 5 percent gravel

Bk or BCk horizon
- Value: 5 or 6 dry, 3 to 6 moist
- Chroma: 4 to 8, dry or moist
- Texture: fine sandy loam, sandy loam
- Clay content: 12 to 18 percent
- Calcium carbonate equivalent: 5 to 35 percent
- Rock fragments: 0 to 20 percent gravel or channers
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Needle soils

Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 38)
Landform: Structural benches (fig. 39)
Geology: Eolian Sand (Quaternary) and White Rim Formation Sandstone (Permian)
Parent material: eolian sands derived from sandstone
Slope: 2 to 15 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	1-5
Rock Fragments:	15-25
Bare Soil:	25-35
Cyanobacteria Crust:	10-15
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 5 to 20 inches to bedrock, lithic
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 0.3 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)

Figure 38.—Profile of Needle soil in map unit 94 (Bluechief-Needle complex, 2 to 15 percent slopes). Lithic contact is at 12 centimeters. Scale is in centimeters.

Ecological site name: Desert Shallow Sandy Loam (Blackbrush)
Ecological site number: R035XY133UT
Present vegetation (in most areas): blackbrush, rubber rabbitbrush, Indian ricegrass, Douglas rabbitbrush, Torrey Mormon tea, broom snakeweed, desert trumpet buckwheat, galleta, gooseberryleaf globemallow
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
585,690 meters E, 4247,769 meters N, zone 12.

C—0 to 5 inches (0 to 13 cm); reddish brown (5YR 5/4) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; many fine irregular pores; 1 percent gravel; slightly effervescent; moderately alkaline, pH 8.0; abrupt wavy boundary.

2R—5 to 15 inches (13 to 38 cm); hard White Rim Formation sandstone bedrock.

Range in Characteristics

C horizon
Hue: 2.5YR, 5YR, 7.5YR
Value: 4 or 5, dry or moist
Chroma: 4 to 8, dry or moist

Figure 39.—Landscape of Needle soil component in map unit 94 (Bluechief-Needle complex, 2 to 15 percent slopes).

Texture: fine sand, loamy sand, loamy fine sand
Clay content: 1 to 12 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 10 percent gravel or channers

95—Goblin very gravelly sandy loam, 6 to 45 percent slopes

Map Unit Setting

General setting: White Rim region of The Maze and Island in the Sky Districts, Canyonlands National Park (fig. 40)
Elevation: 3,980 to 5,210 feet (1,214 to 1,587 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Goblin and similar soils: 90 percent
Minor Components:
- Rock outcrop (Moenkopie Formation sandstone, Schnabkaib Member)
- Moderately deep gypsic soils–Desert Gypsum Loam (Torrey Mormon tea)

Figure 40.—Landscape of map unit 95 (Goblin very gravelly sandy loam, 6 to 45 percent slopes).

Soil Properties and Qualities

Goblin soils
Taxonomic classification: Loamy-skeletal, gypsic, mesic Lithic Haplogypsids (fig. 41)
Landform: Hills
Geology: Moenkopie Formation Sandstone, Schnabkaib Member (Triassic)
Parent material: gypsiferous residuum weathered from sandstone
Slope: 6 to 45 percent, north to northwest aspects

Ground Cover:	(% Cover) (fig. 42)
Plant Canopy:	25-30
Litter <5mm:	3-8
Rock Fragments:	12-20
Bare Soil:	0-5
Cyanobacteria Crust:	8-12
Lichen Crust:	30-40
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	5-10

Depth to restrictive feature(s): 6 to 16 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.5 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high

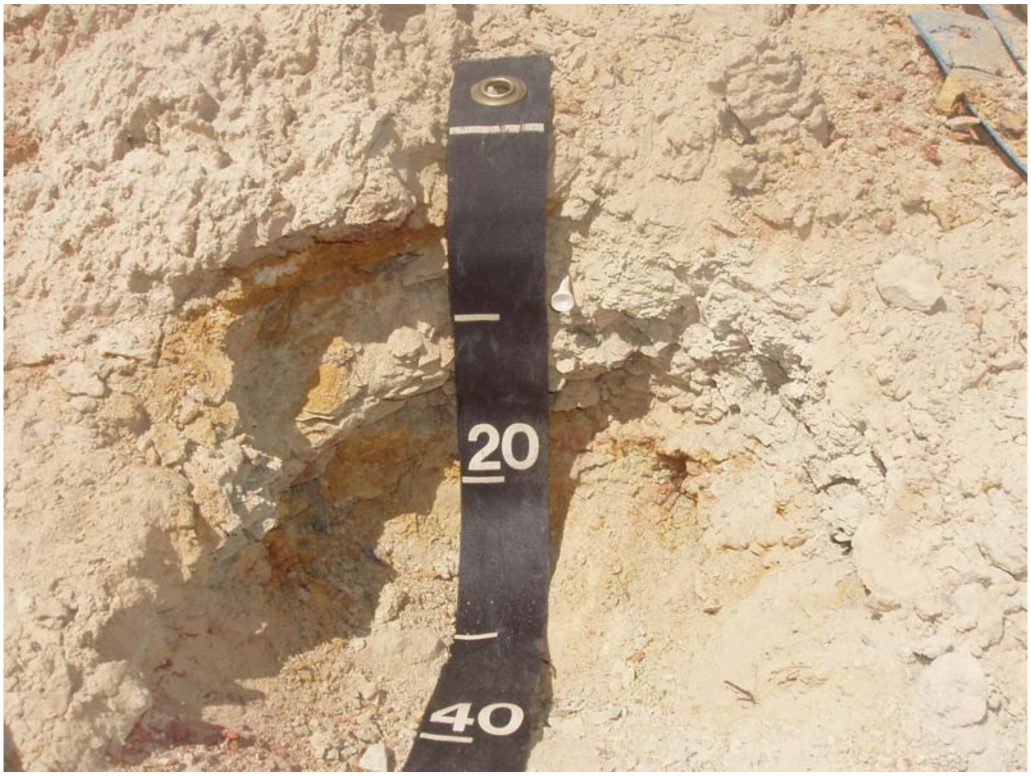


Figure 41.—Profile of Goblin soil in map unit 95 (Goblin very gravelly sandy loam, 6 to 45 percent slopes). Lithic contact is at 23 centimeters. Scale is in centimeters.

Figure 42.—Robust biological and gypsum crust typical of the soil surface in map unit 95 (Goblin very gravelly sandy loam, 6 to 45 percent slopes).

Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: about 40 percent
Salinity maximum: about 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Very Shallow Gypsum (Torrey's Jointfir)
Ecological site number: R035XY142UT
Present vegetation (in most areas): shadscale saltbush, rubber rabbitbrush, galleta, Torrey Mormon tea, scarlet globemallow, buckwheat
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
584,055 meters E, 4232,673 meters N, zone 12.

By1—0 to 3 inches (0 to 8 cm); light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/6), moist; 10 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine and fine tubular pores; many fine irregular gypsum crystals in matrix; 40 percent gravel; slightly effervescent, 2 percent calcium carbonate equivalent and 25 percent gypsum; moderately alkaline, pH 8.0; abrupt wavy boundary.

By2—3 to 9 inches (8 to 23 cm); light yellowish brown (10YR 6/4) extremely channery sandy loam, yellowish brown (10YR 5/6), moist; 11 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine tubular pores; many fine irregular gypsum crystals in matrix; 70 percent channers; very slightly effervescent, 1 percent calcium carbonate equivalent and 30 percent gypsum; moderately alkaline, pH 8.0; abrupt wavy boundary.

R—9 to 19 inches (23 to 48 cm); hard white Moenkopie Formation sandstone, Schnabkaib Member bedrock.

Range in Characteristics

This soil is a taxadjunct to the Goblin series because it contains more than 35 percent rock fragments and secondary gypsum accumulation.

By horizons
- Value: 6 or 7 dry, 3 to 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: sandy loam, fine sandy loam
- Clay content: 10 to 15 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Gypsum: 20 to 40 percent
- Rock fragments: 35 to 70 percent gravel or channers

96—Green River family-Bebeevar complex, 0 to 6 percent slopes

Map Unit Setting

General setting: The River District, Canyonlands National Park (fig. 43)
Elevation: 3,790 to 4,290 feet (1,155 to 1,308 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)

Figure 43.—Settings of map units 96 (Green River family-Bebeevar complex, 0 to 6 percent slopes), 122 (Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery), and 125 (Water) in The River District.

Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Green River family and similar soils: 75 percent
Bebeevar and similar soils: 20 percent
Minor Components:
- Gilco soils–Alkali Bottom (Greasewood)
- Sandbars with no vegetation

Soil Properties and Qualities

Green River family soils
Taxonomic classification: Coarse-loamy, mixed, superactive, calcareous, mesic Oxyaquic Torrifluvents
Landform: Low flood-plain steps (fig. 44)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from mixed sources
Slope: 0 to 6 percent, northeast to west aspects

Ground Cover:	(% Cover)
Plant Canopy:	50-75
Litter <5mm:	15-20
Rock Fragments:	0-5

Bare Soil:	5-10
Cyanobacteria Crust:	0-5
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: somewhat poorly drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 9.3 (high)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: occasional, brief
Ponding hazard: none
Seasonal water table minimum depth: about 2 to 14 inches
Runoff class: low
Hydrologic group: B/D
Calcium carbonate maximum: about 20 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Semiwet Fresh Streambank (Fremont Cottonwood)
Ecological site number: R035XY013UT
Present vegetation (in most areas): tamarisk, halogeton, Russian thistle, Fremont cottonwood, desert olive
Land capability (non irrigated): 6c

Figure 44.—Landscape of Green River family soil in map unit 96 (Green River family-Bebeevar complex, 0 to 6 percent slopes).

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
589,525 meters E, 4248,823 meters N, zone 12.

A—0 to 4 inches (0 to 10 cm); pale brown (10YR 6/3) silt loam, dark brown (7.5YR 3/3), moist; 16 percent clay; moderate very thick parting to moderate thin platy structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots throughout; common very fine and few fine tubular pores; strongly effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

C1—4 to 19.5 inches (10 to 50 cm); brown (10YR 5/3) silt loam, brown (10YR 4/3), moist; 15 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots throughout; common very fine tubular pores; 3 percent medium irregular iron-manganese masses in matrix; strongly effervescent, 17 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C2—19.5 to 78.5 inches (50 to 200 cm); brown (7.5YR 5/3) loamy very fine sand, brown (7.5YR 4/3), moist; 8 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots throughout; few very fine tubular pores; 5 percent medium irregular iron-manganese masses in matrix; strongly effervescent, 12 percent calcium carbonate equivalent; strongly alkaline, pH 8.8.

Range in Characteristics

A horizon
- Hue: 7.5YR, 10YR
- Value: 5 or 6 dry, 3 or 4 moist
- Chroma: 3, dry or moist
- Clay content: 10 to 18 percent
- Calcium carbonate equivalent: 5 to 20 percent
- Rock fragments: none

C horizons
- Hue: 7.5YR, 10YR
- Value: 5 to 7 dry, 4 or 5 moist
- Chroma: 3 to 5, dry or moist
- Texture: silt loam, silty clay loam, loamy very fine sand, fine sand (particle size control section averages 5 to 18 percent clay)
- Clay content: 1 to 18 percent
- Calcium carbonate equivalent: 5 to 20 percent
- Rock fragments: none
- Reaction: moderately alkaline or strongly alkaline (pH 8.4 to 9.0)

Bebeevar soils

Taxonomic classification: Mixed, mesic Oxyaquic Torripsamments (fig. 45)
Landform: Intermediate flood-plain steps (fig. 46)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 0 to 6 percent, southeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	15-20
Rock Fragments:	0-5
Bare Soil:	35-45

Figure 45.—Profile of Bebeevar soil in map unit 96 (Green River family-Bebeevar complex, 0 to 6 percent slopes). Scale is in centimeters.

Cyanobacteria Crust:	0-5
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: moderately well drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 9.4 (high)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: rare, very brief
Ponding hazard: none
Seasonal water table minimum depth: about 8 to 16 inches
Runoff class: low
Hydrologic group: A/D
Calcium carbonate maximum: about 20 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)

Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Sandy Bottom (Fourwing Saltbush)
Ecological site number: R035XY015UT
Present vegetation (in most areas): Russian thistle, cheatgrass, Fremont cottonwood, fourwing saltbush, seepweed, tamarisk, scarlet globemallow
Land capability (non irrigated): 6c

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
588,715 meters E, 4246,227 meters N, zone 12.

A—0 to 3 inches (0 to 7 cm); brown (10YR 5/3) loamy fine sand, brown (10YR 4/3), moist; 7 percent clay; weak thick platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; slightly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C1—3 to 15.5 inches (7 to 40 cm); brown (10YR 5/3) loamy fine sand, brown (10YR 4/3), moist; 9 percent clay; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots throughout; common very fine tubular pores; slightly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C2—15.5 to 43.5 inches (40 to 110 cm); brown (10YR 5/3) loamy fine sand, brown (10YR 4/3), moist; 9 percent clay; single grain; loose, nonsticky and nonplastic; common very fine roots throughout; many very fine irregular pores; 3 percent medium irregular masses of oxidized iron in matrix; slightly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Figure 46.—Landscape of Bebeevar component in map unit 96 (Green River family-Bebeevar complex, 0 to 6 percent slopes).

C3—43.5 to 71 inches (110 to 180 cm); brown (10YR 5/3) silt loam, brown (10YR 4/3), moist; 8 percent clay; massive; hard, firm, nonsticky and nonplastic; common very fine roots throughout; common very fine tubular pores; 8 percent medium irregular masses of oxidized iron in matrix; strongly effervescent, 10 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

This soil is a taxadjunct to the Bebeevar series because it has less than 35 percent coarse fragments and a texture of loamy fine sand or coarser in all layers within the particle size control section.

A horizon
Value: 5 or 6 dry, 4 moist
Chroma: 3, dry or moist
Clay content: 5 to 20 percent
Texture: loam, silt loam, loamy fine sand
Calcium carbonate equivalent: 5 to 20 percent
Rock fragments: none

C horizons
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 3 to 5, dry or moist
Texture: loam, silt loam, loamy fine sand, fine sand
Clay content: 3 to 25 percent (averages 3 to 8 percent in the particle size control section)
Calcium carbonate equivalent: 5 to 20 percent
Rock fragments: none

97—Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery

Map Unit Setting

General setting: Island in the Sky District, Canyonlands National Park (fig. 47)
Elevation: 4,310 to 6,400 feet (1,314 to 1,951 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mathis family and similar soils: 45 percent
Rock outcrop, Jurassic sandstone: 25 percent
Rizno and similar soils: 15 percent
Minor Components:
- Ustic Torripsamments–Semidesert Steep Stony Loam (Blackbrush)
- Ustic Torriorthents–Semidesert Very Steep Stony Loam (Salina wildrye)
- Typic Torriorthents–Desert Very Steep Stony Loam (Shadscale)

Soil Properties and Qualities

Mathis family soils
Taxonomic classification: Sandy-skeletal, mixed, mesic Ustic Torriorthents (fig. 48)
Landform: Talus slopes (fig. 49)

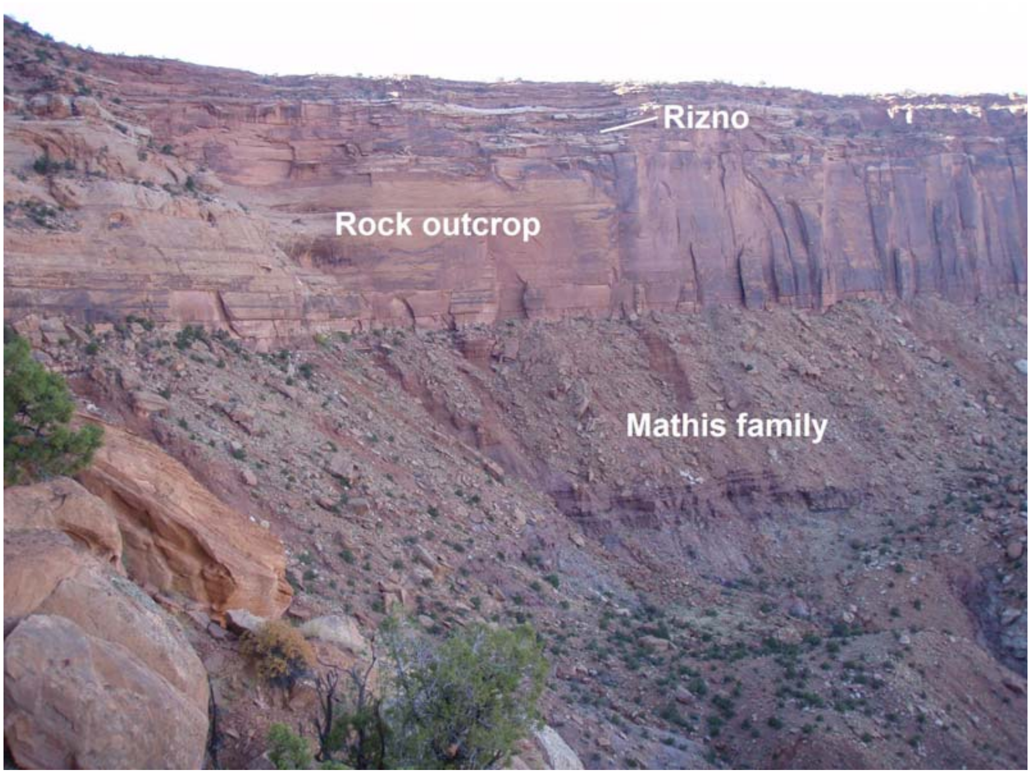


Figure 47.—Landscape of map unit 97 (Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery) on escarpment below mesa of Island in the Sky. The Rock outcrop component is present as vertical cliffs of Wingate Formation sandstone; the Rizno soil component is present on narrow ledges in the upper part of the Rock outcrop; and the Mathis family soil component occupies the bouldery colluvial slope below the Rock outcrop.

Geology: Wingate and Kayenta Formation sandstones over Chinle Formation (Jurassic)
Parent material: colluvium derived from sandstone
Slope: 30 to 70 percent, northeast to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	20-30
Litter <5mm:	3-5
Rock Fragments:	45-50
Bare Soil:	5-10
Cyanobacteria Crust:	10-20
Lichen Crust:	0-3
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to greater than 60 inches
Drainage class: somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 2.2 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: medium

Figure 48.—Profile of Mathis family soil in map unit 97 (Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery). Scale is in centimeters.

Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 1 SAR (slightly sodic)
Ecological site name: Semidesert Very Steep Stony Loam (Pinyon-Utah Juniper)
Ecological site number: R035XY263UT
Present vegetation (in most areas): sumac, Salina wildrye, snowberry, Douglas rabbitbrush, Indian ricegrass, Utah juniper, twoneedle pinyon
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
600,764 meters E, 4242,493 meters N, zone 12.

C1—0 to 8 inches (0 to 20 cm); yellowish red (5YR 5/6) very channery loamy sand, yellowish red (5YR 4/6), moist; 7 percent clay; massive; soft, very friable,

nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; 10 percent cobbles, 10 percent stones, and 20 percent channers; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; gradual wavy boundary.

Figure 49.—Landscape of Mathis family soil component in map unit 97 (Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery).

C2—8 to 71 inches (20 to 180 cm); yellowish red (5YR 5/6) extremely bouldery loamy sand, yellowish red (5YR 4/6), moist; 7 percent clay; massive; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; 5 percent gravel, 10 percent cobbles, 20 percent stones, and 40 percent boulders; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; gradual wavy boundary.

Range in Characteristics

This soil is mapped at the family level because depth to bedrock varies from 20 to greater than 60 inches.

C1 horizon
- Value: 4 to 7 dry, 3 to 5 moist
- Chroma: 6 dry, 4 or 6 moist
- Texture: loamy sand, fine sand
- Clay content: 2 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 30 to 50 percent gravel, channers, cobbles, and stones

C2 horizon
- Hue: 2.5YR, 5YR
- Value: 5 or 6 dry, 4 or 5 moist
- Chroma: 6, dry or moist
- Texture: loamy sand, loamy fine sand, sand
- Clay content: 2 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 35 to 85 percent gravel, channers, stones, and boulders

Rock outcrop, Jurassic sandstone

This component is characterized by many cliffs and escarpments with very steep colluvial and talus slopes. The lithology is sandstone. Slopes generally range from 45 to 100 percent. The vertical relief of the cliffs ranges from a few feet to several tens of feet and is nearly continuous. Rockfall, boulders, and stones dominate the surface. Typically, the steepness, vertical relief, and continuity of cliffs make travel by full-sized four-wheeled vehicles virtually impossible. Travel by foot is difficult and strenuous. This component is usually a natural barrier to livestock and to many terrestrial animals.

Rizno soils

Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 50)
Landform: Ledges, structural benches (fig. 51)
Geology: Kayenta Formation sandstone (Triassic)
Parent material: colluvium derived from sandstone and/or residuum weathered from sandstone
Slope: 15 to 30 percent, east to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	30-35
Litter <5mm:	1-5
Rock Fragments:	8-10
Bare Soil:	30-40
Cyanobacteria Crust:	10-20
Lichen Crust:	3-5
Moss Crust:	3-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 0.3 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: about 1 SAR (slightly sodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): Salina wildrye, Bigelow sagebrush, Indian ricegrass, Utah juniper, twoneedle pinyon, green Mormon tea
Land capability (non irrigated): 7s

Figure 50.—Profile of Rizno soil in map unit 97 (Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery). Lithic contact is at 10 centimeters. Scale is in centimeters.

Figure 51.—Landscape of Rizno soil component in map unit 97 (Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, extremely bouldery) (foreground).

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
603,025 meters E, 4256,598 meters N, zone 12.

A—0 to 1 inch (0 to 3 cm); reddish brown (5YR 5/4) fine sand, reddish brown (5YR 4/4), moist; 6 percent clay; moderate medium platy structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; 3 percent fine gravel; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt smooth boundary.

2C—1 to 4 inches (3 to 10 cm); light reddish brown (5YR 6/4) gravelly fine sandy loam, reddish brown (5YR 5/4), moist; 11 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; carbonate, finely disseminated throughout; 15 percent gravel; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt smooth boundary.

2R—4 to 14 inches (10 to 35 cm); hard Kayenta Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 2.5YR, 5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist
Texture: fine sand, loamy sand, sandy loam
Clay content: 5 to 10 percent

Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 10 percent gravel

C horizon
Hue: 2.5YR, 5YR
Value: 3 to 6 dry, 3 to 5 moist
Chroma: 3 to 6, dry or moist
Texture: fine sandy loam, sandy clay loam, loamy very fine sand
Clay content: 5 to 25 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 25 percent gravel

98—Mellenthin-Wayneco family complex, 1 to 6 percent slopes

Map Unit Setting

General setting: Island in the Sky District and Horseshoe Canyon Districts, Canyonlands National Park (fig. 52)
Elevation: 5,070 to 6,300 feet (1,544 to 1,921 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Figure 52.—Landscape of map unit 98 (Mellenthin-Wayneco family complex, 1 to 6 percent slopes).

Map Unit Composition

Mellenthin and similar soils: 50 percent
Wayneco family and similar soils: 35 percent
Minor Components:
- Shallow soils with a petrocalcic horizon–Semidesert Shallow Sandy Loam (Blackbrush)
- Sazi soils–Semidesert Sand (Blackbrush)
- Arches soils–Semidesert Shallow Sandy Loam (Utah Juniper/Blackbrush)

Soil Properties and Qualities

Mellenthin soils
Taxonomic classification: Loamy-skeletal, mixed, superactive, mesic Lithic Ustic Haplocalcids (fig. 53)
Landform: Mesas
Geology: Navajo Formation sandstone (Jurassic)
Parent material: residuum weathered from sandstone
Slope: 1 to 4 percent, north to northwest aspects

Ground Cover:	(% Cover) (fig. 54)
Plant Canopy:	20-25
Litter <5mm:	0-5
Rock Fragments:	20-25
Bare Soil:	10-15
Cyanobacteria Crust:	35-45
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 1.0 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 50 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Blackbrush)
Ecological site number: R035XY233UT
Present vegetation (in most areas): blackbrush, Utah juniper, Torrey Mormon tea
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
596,202 meters E, 4250,396 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); strong brown (7.5YR 5/6) very gravelly loamy fine sand, strong brown (7.5YR 4/6), moist; 8 percent clay; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very

Figure 53.—Profile of Mellenthin soil in map unit 98 ((Mellenthin-Wayneco family complex, 1 to 6 percent slopes). The calcic horizon begins at 11 centimeters, and the lithic contact is at 40 centimeters.

Figure 54.—Typical surface of map unit 98 (Mellenthin-Wayneco family complex, 1 to 6 percent slopes).

fine and fine roots throughout; common very fine irregular pores; 40 percent gravel; strongly effervescent, 10 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear wavy boundary.

Bk1—4.5 to 12 inches (11 to 31 cm); yellowish red (5YR 5/6) very gravelly fine sandy loam, yellowish red (5YR 4/6), moist; 12 percent clay; weak coarse parting to weak medium subangular blocky structure; hard, firm, slightly sticky and nonplastic; common fine roots throughout; common very fine irregular pores; many distinct carbonate coats on rock fragments; carbonate, finely disseminated throughout; 50 percent gravel; violently effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt smooth boundary.

Bk2—12 to 15.5 inches (31 to 40 cm); reddish yellow (5YR 7/6) very gravelly sandy loam, yellowish red (5YR 5/6), moist; 14 percent clay; weak fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common fine roots throughout; common very fine irregular pores; many carbonate coats on rock fragments; carbonate, finely disseminated throughout; 45 percent gravel; violently effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

R—15.5 to 25.5 inches (40 to 65 cm); hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5 moist
- Texture: loamy fine sand, fine sandy loam, sandy loam
- Clay content: 5 to 15 percent
- Calcium carbonate equivalent: 5 to 15 percent
- Rock fragments: 5 to 50 percent gravel

Bk horizon
- Value: 5 to 7 dry, 4 or 5 moist
- Texture: fine sandy loam, sandy loam
- Clay content: 10 to 18 percent
- Calcium carbonate equivalent: 15 to 50 percent
- Rock fragments: 35 to 60 percent gravel
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Wayneco family soils

Taxonomic classification: Loamy, mixed, superactive, mesic Lithic Ustic Haplocalcids (fig. 55)
Landform: Mesas
Geology: Navajo Formation sandstone (Jurassic)
Parent material: residuum weathered from calcareous sandstone
Slope: 2 to 6 percent, southwest to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	45-55
Litter <5mm:	1-8
Rock Fragments:	5-10
Bare Soil:	25-30
Cyanobacteria Crust:	20-30
Lichen Crust:	0-5
Moss Crust:	0-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 0 to 16 inches to bedrock, paralithic; 4 to 20 inches to bedrock, lithic

Figure 55.—Profile of Wayneco family soil in map unit 98 (Mellenthin-Wayneco family complex, 1 to 6 percent slopes). Calcic horizon begins at 12 centimeters, lithic contact is at 26 centimeters. Scale is in centimeters.

Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 1.6 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 50 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Semidesert Shallow Sandy Loam (Blackbrush)
Ecological site number: R035XY233UT
Present vegetation (in most areas): blackbrush, Fremont's mahonia, Jones' pepperweed, Indian ricegrass, Torrey Mormon tea, green Mormon tea
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
596,175 meters E, 4251,638 meters N, zone 12.

A—0 to 2 inches (0 to 5 cm); reddish brown (5YR 5/4) gravelly loamy fine sand, reddish brown (5YR 4/4), moist; 9 percent clay; weak fine subangular blocky and

moderate medium platy structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; 20 percent fine gravel; strongly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

Bw—2 to 6.5 inches (5 to 16 cm); reddish brown (2.5YR 5/4) fine sandy loam, reddish brown (2.5YR 4/4), moist; 15 percent clay; moderate medium parting to moderate fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; common fine spherical carbonate masses in matrix; 5 percent fine gravel; strongly effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

Bk1—6.5 to 10 inches (16 to 26 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 18 percent clay; moderate medium parting to moderate fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; carbonate, finely disseminated throughout and common medium irregular carbonate masses throughout; 5 percent channers violently effervescent, 30 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Bk2—10 to 14.5 inches (26 to 37 cm); pink (5YR 7/4) channery sandy loam, light reddish brown (5YR 6/4), moist; 13 percent clay; moderate medium parting to moderate fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; carbonate, finely disseminated throughout; 30 percent channers; violently effervescent, 50 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Cr—14.5 to 17 inches (37 to 43 cm); soft Navajo Formation calcareous sandstone bedrock; abrupt wavy boundary.

R—17 to 27 inches (43 to 68 cm); hard Navajo Formation calcareous sandstone bedrock.

Range in Characteristics

This soil is mapped at the family level because most pedons have more than 15 percent rock fragments in some horizon, greater than the series allows.

Some pedons have thin horizons above the bedrock that are cemented with carbonates.

A horizon
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 4 or 6, dry or moist
Texture: loamy fine sand, sandy loam
Clay content: 8 to 18 percent
Calcium carbonate equivalent: 5 to 15 percent
Rock fragments: 20 to 40 percent gravel

Bw horizon
Value: 4 or 5, dry or moist
Chroma: 4 or 6, dry or moist
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 15 to 50 percent
Rock fragments: 5 to 20 percent gravel

Bk horizon
Hue: 5YR, 7.5YR
Value: 5 to 8 dry, 4 to 6 moist

Value: 5 to 8 dry, 4 to 6 moist
Chroma: 4 or 6, dry or moist
Texture: fine sandy loam, sandy loam
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 15 to 50 percent
Rock fragments: 5 to 30 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

99—Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes

Map Unit Setting

General setting: The Needles District, Canyonlands National Park
Elevation: 4,630 to 6,230 feet (1,412 to 1,898 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido family, occasionally flooded and similar soils: 70 percent
Green River family and similar soils: 15 percent
Minor Components:
- Mido family, sodic soils–Alkali Bottom (Greasewood)
- Riverwash areas with no vegetation
- Rizno soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Loamy soils that have a seasonal water table within 10 centimeters of the soil surface–Semiwet Fresh Streambank (Freemont Cottonwood)

Soil Properties and Qualities

Mido family, occasionally flooded soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 56)
Landform: Intermediate flood-plain steps (fig. 57)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 1 to 6 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	20-30
Litter <5mm:	1-5
Rock Fragments:	0
Bare Soil:	25-35
Cyanobacteria Crust:	20-30
Lichen Crust:	10-15
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)

Figure 56.—Profile of Mido family, occasionally flooded, soil in map unit 99 (Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes). Scale is in centimeters.

Available water capacity total inches: about 4.7 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: occasional, very brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Loamy Bottom (Basin Big Sagebrush)
Ecological site number: R035XY011UT
Present vegetation (in most areas): tamarisk, basin big sagebrush, Louisiana sagewort, tansymustard
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
609,970 meters E, 4224,761 meters N, zone 12.

A—0 to 3 inches (0 to 8 cm); reddish brown (5YR 5/4) very fine sand, reddish brown (5YR 4/4), moist; 4 percent clay; weak thick platy structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt smooth boundary.

C1—3 to 12 inches (8 to 31 cm); reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic;

Figure 57.—Landscape of Mido family, occasionally flooded, soil component in map unit 99 (Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes).

common fine roots throughout; common fine interstitial pores; slightly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.

C2—12 to 17.5 inches (31 to 45 cm); reddish brown (5YR 5/4) loamy fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt smooth boundary.

C3—17.5 to 43.5 inches (45 to 111 cm); strong brown (7.5YR 5/6) fine sand, strong brown (7.5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C4—43.5 to 65.5 inches (111 to 167 cm); reddish yellow (7.5YR 6/6) sand, strong brown (7.5YR 4/6), moist; 4 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; 5 percent fine gravel; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C5—65.5 to 76 inches (167 to 193 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 4 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

This soil is mapped at the family level because it is found on flood-plain steps, experiences occasional flooding, and is fluvial in origin.

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 to 6, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: very fine sand, loamy fine sand
- Clay content: 1 to 5 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: none

C horizons
- Hue: 5YR, 7.5YR
- Value: 5 or 6 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sand, loamy fine sand, sand
- Clay content: 1 to 8 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: 0 to 5 percent gravel

Green River family soils

Taxonomic classification: Coarse-loamy, mixed, superactive, calcareous, mesic Oxyaquic Torrifluvents (fig. 58)
Landform: Low flood-plain steps (fig. 59)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 0 to 1 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	60-70

Litter <5mm:	20-30
Rock Fragments:	0
Bare Soil:	3-5
Cyanobacteria Crust:	0
Lichen Crust:	0
Moss Crust:	0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: moderately well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 6.3 (moderate)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: frequent, very brief
Ponding hazard: none
Seasonal water table minimum depth: about 20 to 40 inches
Runoff class: very low
Hydrologic group: A/D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 1 SAR (slightly sodic)

Figure 58.—Profile of Green River family soil in map unit 99 (Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes). Scale is in centimeters.

Figure 59.—Landscape of Green River family soil component in map unit 99 (Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes).

Ecological site name: Semiwet Fresh Streambank (Fremont Cottonwood)
Ecological site number: R035XY013UT
Present vegetation (in most areas): Fremont cottonwood, coyote willow, willow, Baltic rush, bluegrass, field horsetail, groundsel, tamarisk
Land capability (non irrigated): 7w

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
607,798 meters E, 4211,866 meters N, zone 12.

A—0 to 1 inch (0 to 3 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 4 percent clay; weak very fine subangular blocky and weak thin platy structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; very abrupt smooth boundary.

C1—1 inch to 11.5 inches (3 to 29 cm); yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6), moist; 15 percent clay; massive; soft, very friable, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C2—11.5 to 21.5 inches (29 to 55 cm); yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6), moist; 16 percent clay; massive; soft, very friable, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; gradual smooth boundary.

C3—21.5 to 71 inches (55 to 180 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 4 percent clay; massive; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; 5 percent medium irregular masses of oxidized iron throughout; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

Range in Characteristics

Green River soils are mapped at the family level because of the predominantly red colors, which are outside of the range of the Green River series.

A horizon
Hue: 5YR, 7.5YR
Value: 4 to 6, dry or moist
Chroma: 4 or 6, dry or moist
Texture: very fine sand, fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

C horizons
Value: 4 to 6 dry, 4 or 5 moist
Chroma: 4 or 6, dry or moist
Texture: very fine sandy loam, fine sand, loamy coarse sand, loamy fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 10 percent
Rock fragments: 0 to 5 percent gravel

100—Mido family, sodic, 0 to 8 percent slopes

Map Unit Setting

General setting: The Needles District, Canyonlands National Park (fig. 60)
Elevation: 4,590 to 4,970 feet (1,398 to 1,516 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido family, sodic and similar soils: 70 percent
Minor Components:
- Mido family, occasionally flooded, soils–Loamy Bottom (Basin Sagebrush)
- Green River soils–Semiwet Fresh Streambank (Freemont Cottonwood)
- Other deep sandy soils–Alkali Flat (Greasewood)

Soil Properties and Qualities

Mido family, sodic soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 61)
Landform: Stream terraces
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 0 to 8 percent, north aspect

Figure 60.—Landscape of map unit 100 (Mido family, sodic, 0 to 8 percent slopes).

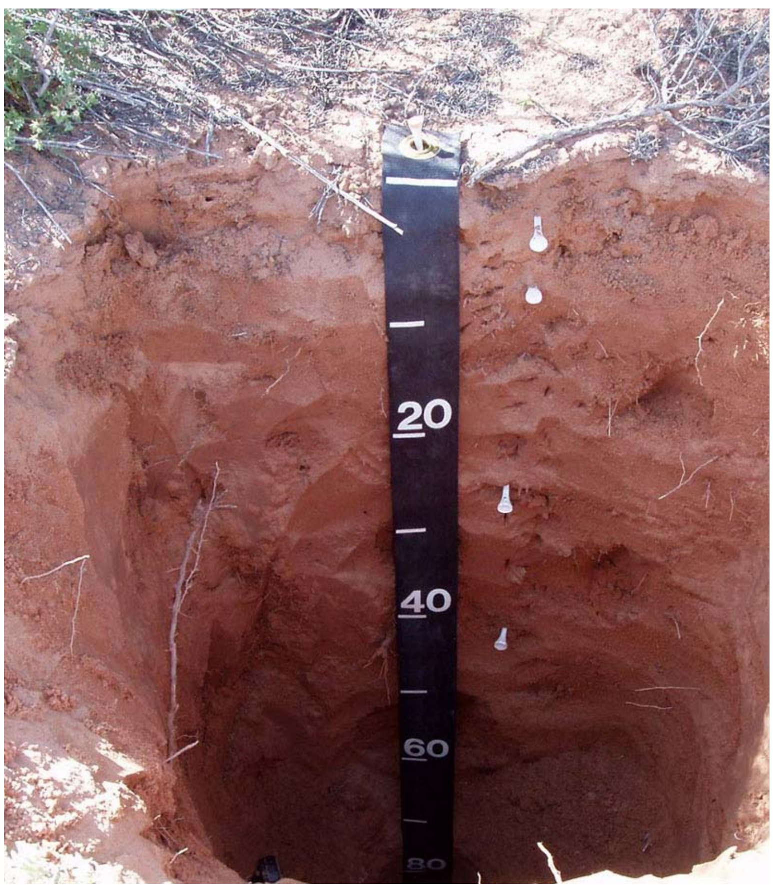


Figure 61.—Profile of Mido family, sodic, soil in map unit 100 (Mido family, sodic, 0 to 8 percent slopes). Scale is in centimeters.

Figure 62.—Typical surface in map unit 100 (Mido family, sodic, 0 to 8 percent slopes). The amount of sodium is typically high at the surface in this map unit. Note the "slick spots" near the shrubs, an indicator of high sodium. Biological crusts also thrive on the surface of these relatively salty soils.

Ground Cover:	(% Cover) (fig. 62)
Plant Canopy:	55-65
Litter <5mm:	1-5
Rock Fragments:	0
Bare Soil:	20-30
Cyanobacteria Crust:	5-10
Lichen Crust:	1-5
Moss Crust:	1-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 5.0 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: very rare, very brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: about 20 SAR (moderately sodic)

Ecological site name: Alkali Bottom (Greasewood)
Ecological site number: R035XY003UT
Present vegetation (in most areas): greasewood, fourwing saltbush, spike dropseed, Indian ricegrass, sand dropseed, seepweed
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
608,197 meters E, 4226,181 meters N, zone 12.

A1—0 to 1.5 inches (0 to 4 cm); reddish yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6), moist; 3 percent clay; weak medium subangular blocky and moderate very thick platy structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; many very fine irregular pores; 2 percent fine gravel; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

A2—1.5 to 3.5 inches (4 to 9 cm); fine sand, strong brown (7.5YR 4/6), moist; 2 percent clay; moderate coarse parting to moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; many very fine irregular pores; 1 percent fine gravel; slightly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; clear smooth boundary.

Bw1—3.5 to 10.5 inches (9 to 27 cm); loamy fine sand, yellowish red (5YR 5/8), moist; 6 percent clay; moderate coarse parting to moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; 2 percent fine gravel; strongly effervescent, 5 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; clear smooth boundary.

Bw2—10.5 to 18 inches (27 to 46 cm); loamy fine sand, yellowish red (5YR 4/6), moist; 7 percent clay; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; 3 percent fine gravel; strongly effervescent, 5 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; clear smooth boundary.

C1—18 to 41.5 inches (46 to 105 cm); fine sand, yellowish red (5YR 4/6), moist; 4 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; 2 percent fine gravel; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C2—41.5 to 76.5 inches (105 to 194 cm); fine sand, reddish brown (5YR 4/4), moist; 2 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common very fine interstitial pores; 5 percent fine gravel; strongly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; clear smooth boundary.

Range in Characteristics

This soil is mapped at the family level because it is found on stream terraces, experiences very rare flooding, and is fluvial in origin.

A horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 6, dry or moist
Texture: fine sand, loamy fine sand, fine sandy loam
Clay content: 3 to 10 percent

Calcium carbonate equivalent: 1 to 5 percent
Electrical conductivity: 0 to 4 mmhos/cm
Rock fragments: 0 to 5 percent
Reaction: 7.9 to 9.5 (moderately alkaline or strongly alkaline)

Bw horizon
Value: 4 or 5, dry or moist
Chroma: 6 dry, 4 to 8 moist
Texture: loamy fine sand, very fine sandy loam, fine sandy loam
Clay content: 5 to 15 percent
Calcium carbonate equivalent: 1 to 5 percent
Electrical conductivity: 0 to 4 mmhos/cm
Rock fragments: 0 to 5 percent
Reaction: 7.9 to 9.5 (moderately alkaline to very strongly alkaline)

C horizon
Value: 4 or 5, dry or moist
Chroma: 4 or 6, dry or moist
Texture: fine sand, loamy fine sand
Clay content: 3 to 8 percent
Calcium carbonate equivalent: 1 to 5 percent
Electrical conductivity: 4 to 8 mmhos/cm
Rock fragments: 0 to 5 percent gravel
Reaction: 7.9 to 9.5 (moderately alkaline or strongly alkaline)

101—Mido fine sand, 0 to 6 percent slopes

Map Unit Setting

General setting: The Maze and The Needles Districts, Canyonlands National Park
Elevation: 4,370 to 5,930 feet (1,333 to 1,806 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido and similar soils: 90 percent
Minor Components:
- Begay soils–Semidesert Sandy Loam (Fourwing Saltbush)

Soil Properties and Qualities

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (figs. 63, 64)
Landform: Grabens (fig. 65)
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 0 to 6 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	15-35
Litter <5mm:	30-45
Rock Fragments:	0

Bare Soil:	20-30
Cyanobacteria Crust:	5-10
Lichen Crust:	1-5
Moss Crust:	10-20
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 6.4 (moderate)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A

Figure 63.—Profile of Mido soil in map unit 101 (Mido fine sand, 0 to 6 percent slopes). Scale is in centimeters.

Figure 64.—Platy surface structure typical of Mido soils in map unit 101 (Mido fine sand, 0 to 6 percent slopes).

Figure 65.—Landscape of map unit 101 (Mido fine sand, 0 to 6 percent slopes), showing the view from inside a graben; grabens are long, narrow fault-caused valleys, typically bounded on either side by steep cliffs and escarpments.

Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)
Ecological site number: R035XY212UT
Present vegetation (in most areas): sand dropseed, Indian ricegrass, Russian thistle, fourwing saltbush, cheatgrass, sand sagebrush, tansymustard
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
592,185 meters E, 4223,015 meters N, zone 12.

A—0 to 3 inches (0 to 8 cm); reddish brown (5YR 5/4) fine sand, reddish brown (5YR 4/4), moist; 2 percent clay; moderate thick platy structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; 1 percent gravel; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

Bw—3 to 23.5 inches (8 to 60 cm); reddish brown (5YR 5/4) fine sand, reddish brown (5YR 4/4), moist; 2 percent clay; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

C—23.5 to 78.5 inches (60 to 200 cm); reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4), moist; 6 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common very fine interstitial pores; strongly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.2.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 4 or 5, dry or moist
Chroma: 3 or 4, dry or moist
Texture: fine sand, loamy fine sand
Clay content: 2 to 6 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 2 percent gravel

Bw horizon
Value: 4 or 5, dry or moist
Clay content: 2 to 4 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 2 percent gravel

C horizon
Value: 4 or 5, dry or moist
Texture: loamy fine sand, fine sand
Clay content: 2 to 6 percent
Calcium carbonate equivalent: 1 to 10 percent
Rock fragments: 0 to 5 percent gravel

Bw horizon is too coarse to qualify as cambic.

102—Mido fine sand, 2 to 15 percent slopes

Map Unit Setting

General setting: The Needles, The Maze, and Island in the Sky Districts, Canyonlands National Park
Elevation: 4,890 to 6,160 feet (1,490 to 1,879 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido and similar soils: 95 percent
Minor Components:
- Sazi soils–Semidesert Sandy Loam (Blackbrush)
- Rock outcrop (Sandstone)

Soil Properties and Qualities

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 66)
Landform: Upper valley sides, mesas (fig. 67)
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone

Figure 66.—Profile of Mido soil in map unit 102 (Mido fine sand, 2 to 15 percent slopes). Scale is in centimeters.

Figure 67.—Landscape of map unit 102 (Mido fine sand, 2 to 15 percent slopes) in the Needles District.

Slope: 2 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	3-8
Rock Fragments:	0-5
Bare Soil:	45-55
Cyanobacteria Crust:	0-5
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 4.7 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Semidesert Sand (Blackbrush)

Ecological site number: R035XY210UT
Present vegetation (in most areas): blackbrush, Torrey Mormon tea, buckwheat, Indian ricegrass, fourwing saltbush
Land capability (non irrigated): 6s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
610,567 meters E, 4223,250 meters N, zone 12.

A—0 to 1.5 inches (0 to 4 cm); yellowish red (5YR 4/6) fine sand, (5YR 3/6), moist; 2 percent clay; moderate thick platy structure; soft, very friable; common fine roots throughout; common fine irregular pores; 5 percent gravel; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.
C1—1.5 to 10.5 inches (4 to 27 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 5 percent clay; massive; slightly hard, friable; common fine roots throughout; common fine irregular pores; 1 percent gravel and; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; gradual smooth boundary.
C2—10.5 to 25.5 inches (27 to 65 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; 1 percent gravel; slightly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; gradual smooth boundary.
C3—25.5 to 66.5 inches (65 to 169 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; 1 percent gravel; strongly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; abrupt smooth boundary.
C4—66.5 to 78.5 inches (169 to 200 cm); red (2.5YR 5/6) fine sand, red (2.5YR 4/6), moist; 5 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common fine interstitial pores; 1 percent gravel; strongly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6.

Range in Characteristics

A horizon
Hue: 2.5YR, 5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 6, dry or moist
Texture: fine sand, sand, loamy fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel

C horizons
Hue: 2.5YR, 5YR
Value: 5 to 7 dry, 4 or 6 moist
Chroma: 3 to 6 dry, 4 or 6 moist
Texture: fine sand, loamy sand, loamy fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel
Reaction: 7.9 to 9.0 (moderately alkaline or strongly alkaline)

103—Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Maze and The Needles Districts, Canyonlands National Park
Elevation: 4,580 to 6,650 feet (1,396 to 2,028 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido and similar soils: 35 percent
Batterson and similar soils: 30 percent
Rock outcrop, Cedar Mesa sandstone: 15 percent
Minor Components:
- Shallow skeletal soils–Semidesert Shallow Sandy loam (Utah Juniper/Blackbrush)
- Rizno soils–Semidesert Shallow Sandy loam (Utah Juniper/Blackbrush)

Soil Properties and Qualities

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 68)
Landform: Dunes on mesas, dunes on structural benches (fig. 69)
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: alluvium derived from sandstone and/or eolian sands
Slope: 2 to 15 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-45
Litter <5mm:	1-5
Rock Fragments:	0-2
Bare Soil:	15-20
Cyanobacteria Crust:	20-30
Lichen Crust:	5-10
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 4.3 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Semidesert Sand (Blackbrush)

Figure 68.—Profile of Mido soil in map unit 103 (Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes). Scale is in centimeters.

Ecological site number: R035XY210UT
Present vegetation (in most areas): blackbrush, fourwing saltbush, Cutler Mormon tea, Indian ricegrass, Utah juniper, needle and thread
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
591,072 meters E, 4225,076 meters N, zone 12.

A—0 to 4 inches (0 to 10 cm); reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots throughout; common very fine and few fine tubular pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

2C1—4 to 47 inches (10 to 120 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; massive; slightly hard, friable, nonsticky and

nonplastic; common very fine and few fine roots throughout; common very fine and few fine tubular pores; 2 percent fine gravel; strongly effervescent, 4 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; gradual wavy boundary.

2C2—47 to 71 inches (120 to 180 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; few very fine roots throughout; common very fine interstitial pores; 5 percent fine gravel; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2.

Range in Characteristics

A horizon
- Value: 4 or 6, dry or moist
- Chroma: 4 or 5, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: none

C1 or 2C1 horizon
- Value: 5 to 7 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sand, loamy fine sand
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent

Figure 69.—Landscape of Mido soil in map unit 103 (Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes).

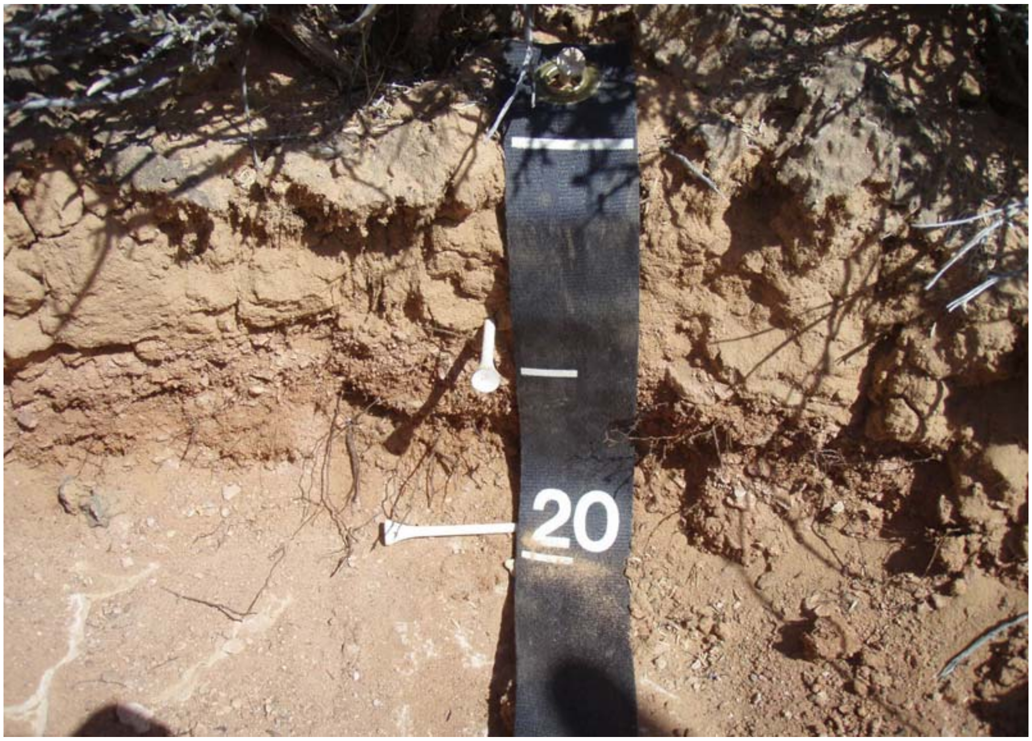


Figure 70.—Profile of Batterson soil in map unit 103 (Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes). Lithic contact is at 19 centimeters. Scale is in centimeters.

Rock fragments: 0 to 5 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

C2 or 2C2 horizon
Hue: 2.5YR, 5YR
Value: 5 or 6, dry or moist
Texture: fine sand, loamy fine sand, sand, loamy sand
Clay content: 1 to 6 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 20 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Batterson soils

Taxonomic classification: Sandy, mixed, mesic Lithic Ustic Torriorthents (fig. 70)
Landform: Mesas, structural benches (fig. 71)
Geology: Cedar Mesa Formation sandstone (Permian)
Parent material: eolian sands and/or residuum weathered from sandstone
Slope: 2 to 15 percent, east to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	25-30
Litter <5mm:	1-5
Rock Fragments:	3-8
Bare Soil:	30-35
Cyanobacteria Crust:	3-8
Lichen Crust:	25-30
Moss Crust:	3-8
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 17 inches to bedrock, paralithic; 4 to 20 inches to bedrock, lithic
Drainage class: excessively drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.3 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 20 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): blackbrush, Utah juniper, pinyon, roundleaf buffaloberry, fourwing saltbush, galleta
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
591,007 meters E, 4225,040 meters N, zone 12.

Figure 71.—Landscape of Batterson soil component in map unit 103 (Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes).

A—0 to 3 inches (0 to 8 cm); reddish yellow (5YR 6/6) fine sand, reddish brown (5YR 4/4), moist; 2 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots throughout; common very fine and few fine tubular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

2C—3 to 5.5 inches (8 to 14 cm); red (2.5YR 4/6) very gravelly coarse sand, dark reddish brown (2.5YR 3/4), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; common very fine, few fine and medium roots throughout; many very fine interstitial pores; 40 percent fine gravel; violently effervescent, 18 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

2Cr—5.5 to 7 inches (14 to 18 cm); soft Cedar Mesa Formation sandstone bedrock; abrupt wavy boundary.

2R—7 to 17 inches (18 to 43 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 5 or 6 dry, 4 or 6 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sand, loamy fine sand, loamy coarse sand
- Clay content: 1 to 5 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 20 percent gravel

2C horizon
- Hue: 2.5YR, 5YR, 7.5YR
- Value: 4 to 6 dry, 3 to 6 moist
- Chroma: 4 to 8 dry, 4 or 6 moist
- Texture: coarse sand, loamy coarse sand, fine sandy loam
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 15 to 50 percent gravel
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

The particle size control section averages less than 35 percent coarse fragments.

Rock outcrop, Cedar Mesa sandstone
This component is characterized by gently sloping to steep rock outcrop. The lithology is sandstone. Slopes generally range from 2 to 30 percent. Typically, there are very few, nearly vertical cliffs to impede vehicular travel. The vertical relief is usually a few feet to several feet. Because of the steepness of slopes, the area can be negotiated by full-sized four-wheeled vehicles with care. There are no impediments to foot travel or to the movement of animals.

104—Mido-Begay complex, 0 to 6 percent slopes

Map Unit Setting

General setting: The Maze and The Needles Districts, Canyonlands National Park
Elevation: 4,820 to 6,140 feet (1,470 to 1,873 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)

Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido and similar soils: 65 percent
Begay and similar soils: 30 percent
Minor Components:
- Other deep sandy soils on climbing dunes–Semidesert Sand (Fourwing Saltbush)
- Arches soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Batterson soils–Semidesert Sandy Loam (Blackbrush)
- Rock outcrop (Cedar Mesa Formation sandstone)

Soil Properties and Qualities

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 72)
Landform: Valley sides (fig. 73)
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 6 percent, northeast to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	65-75
Litter <5mm:	3-5
Rock Fragments:	0
Bare Soil:	15-25
Cyanobacteria Crust:	0-3
Lichen Crust:	0-3
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 4.7 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 1 SAR (slightly sodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)
Ecological site number: R035XY212UT
Present vegetation (in most areas): Indian ricegrass, galleta, fourwing saltbush, purple threeawn, winterfat
Land capability (non irrigated): 6s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
610,532 meters E, 4223,227 meters N, zone 12.

Figure 72.—Profile of Mido soil in map unit 104 (Mido-Begay complex, 0 to 6 percent slopes). Scale is in centimeters.

A—0 to 2.5 inches (0 to 6 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; weak thick platy parting to weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; many fine irregular pores; 2 percent gravel; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear smooth boundary.

C1—2.5 to 24 inches (6 to 61 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; many fine irregular pores; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; gradual smooth boundary.

C2—24 to 70 inches (61 to 178 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots throughout; common fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; gradual smooth boundary.

Figure 73.—Landscape of Mido soil component in map unit 104 (Mido-Begay complex, 0 to 6 percent slopes).

C3—70 to 78.5 inches (178 to 200 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots throughout; common fine irregular pores; 1 percent gravel; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2.

Range in Characteristics

A horizon
Hue: 2.5YR, 5YR, 7.5YR
Value: 4 to 6, dry or moist
Chroma: 4 or 6, dry or moist
Texture: fine sand, loamy sand, loamy fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 2 percent gravel

C horizon
Hue: 2.5YR, 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 6 moist
Chroma: 3 to 6 dry, 4 to 6 moist
Texture: fine sand, loamy sand, loamy fine sand
Clay content: 1 to 8 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel
Reaction: 7.9 to 9.0 (moderately alkaline or strongly alkaline)

Bw horizons are present in some pedons but are too coarse to qualify as cambic horizons.

Begay soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids (fig. 74)

Landform: Valley floors (fig. 75)

Geology: Eolian sand and slope alluvium (Quaternary)

Parent material: alluvium derived from sandstone and/or slope alluvium derived from sandstone

Slope: 0 to 2 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	5-10
Rock Fragments:	0
Bare Soil:	35-45
Cyanobacteria Crust:	0-3
Lichen Crust:	0-3
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Figure 74.—Profile of Begay soil in map unit 104 (Mido-Begay complex, 0 to 6 percent slopes). Scale is in centimeters.

Figure 75.—Landscape of Begay soil component in map unit 104 (Mido-Begay complex, 0 to 6 percent slopes) in the Maze District.

Depth to restrictive feature(s): greater than 60 inches
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 9.4 (high)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: rare
Seasonal water table minimum depth: greater than 60 inches
Runoff class: negligible
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 1 SAR (slightly sodic)
Ecological site name: Semidesert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY215UT
Present vegetation (in most areas): galleta, fourwing saltbush, Indian ricegrass, winterfat, rubber rabbitbrush, stickseed, cheatgrass
Land capability (non irrigated): 6c

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
605,787 meters E, 4222,783 meters N, zone 12.

A—0 to 1.5 inches (0 to 4 cm); reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4), moist; 15 percent clay; weak thick platy structure; slightly hard, friable,

slightly sticky and nonplastic; common fine roots throughout; many fine pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt smooth boundary.

BA—1.5 to 7 inches (4 to 18 cm); reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4), moist; 13 percent clay; weak coarse parting to moderate medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; violently effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.

Bw1—7 to 27.5 inches (18 to 70 cm); yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6), moist; 14 percent clay; moderate coarse parting to moderate medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; violently effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear smooth boundary.

Bw2—27.5 to 37.5 inches (70 to 95 cm); yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6), moist; 15 percent clay; weak medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; common fine irregular carbonate masses in matrix; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C1—37.5 to 51 inches (95 to 130 cm); reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6), moist; 5 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; common coarse irregular carbonate masses in matrix; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt smooth boundary.

C2—51 to 75.5 inches (130 to 192 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 5 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; carbonate, finely disseminated throughout and common coarse irregular carbonate masses in matrix; violently effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 to 6, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: loam, very fine sandy loam, loamy very fine sand
- Clay content: 5 to 18 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 2 percent gravel

Bw horizon
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Texture: very fine sandy loam, fine sandy loam, loam, loamy very fine sand
- Clay content: 5 to 18 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 5 percent
- Reaction: 7.9 to 9.0 (moderately alkaline or strongly alkaline)

C horizons
- Hue: 2.5YR, 5YR

Value: 4 to 6 dry, 3 or 4 moist
Chroma: 4 to 6, dry or moist
Texture: loamy fine sand, loamy sand, fine sand, fine sandy loam
Clay content: 5 to 18 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel
Reaction: 7.9 to 9.0 (moderately alkaline or strongly alkaline)

105—Mido-Mido family, frequently flooded, complex, 1 to 15 percent slopes

Map Unit Setting

General setting: The Maze and Horseshoe Canyon Districts, Canyonlands National Park
Elevation: 4,180 to 5,180 feet (1,273 to 1,579 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Mido and similar soils: 65 percent
Mido family, frequently flooded and similar soils: 15 percent
Minor Components:
- Riverwash with no vegetation
- Escavada soils–Sandy Bottom (Fourwing Saltbush)
- Other deep sandy soils–Semidesert Sand (Blackbrush)
- Shallow soils–Shallow Sand Rock Pocket (Utah Juniper-Pinyon)
- Colluvial soils–Semidesert Sandy Loam (Blackbrush)

Soil Properties and Qualities

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 76)
Landform: Dunes on terraces, structural benches (fig. 77)
Geology: Alluvium and eolian sands (Quaternary)
Parent material: alluvium derived from sandstone, eolian sands
Slope: 2 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	8-12
Rock Fragments:	0-1
Bare Soil:	35-40
Cyanobacteria Crust:	0-1
Lichen Crust:	3-8
Moss Crust:	8-12
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: Greater than 20 in/hr (very rapid)
Available water capacity total inches: about 3.4 (low)

Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: rare, extremely brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)
Ecological site number: R035XY212UT
Present vegetation (in most areas): sand sagebrush, Indian ricegrass, fourwing saltbush, sand dropseed, needle and thread, gooseberryleaf globemallow
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
588,520 meters E, 4230,960 meters N, zone 12.

A—0 to 8 inches (0 to 20 cm); strong brown (7.5YR 5/6) fine sand, strong brown (7.5YR 4/6), moist; 1 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots throughout; many very fine irregular pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt wavy boundary.

Figure 76.—Profile of Mido soil in map unit 105 (Mido-Mido family, frequently flooded, complex, 1 to 15 percent slopes). Scale is in centimeters.

Figure 77.—Landscape of Mido soil component in map unit 105 (Mido-Mido family, frequently flooded, complex, 1 to 15 percent slopes) in the Maze District.

Bw—8 to 36 inches (20 to 91 cm); strong brown (7.5YR 5/6) fine sand, strong brown (7.5YR 4/6), moist; 1 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots throughout; many very fine irregular pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

C—36 to 49 inches (91 to 125 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; many very fine and common fine roots throughout; many very fine interstitial pores; 1 percent gravel; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

2C—49 to 59 inches (125 to 150 cm); yellowish red (5YR 5/6) gravelly sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine interstitial pores; 20 percent gravel; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

Range in Characteristics

A horizon

Hue: 5YR, 7.5YR
Value: 4 to 6, dry or moist
Chroma: 4 or 6, dry or moist
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent

Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Bw and C horizons
Hue: 5YR, 7.5YR
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel

2C horizon
Texture: sand, fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 20 to 60 percent gravel

Mido family, frequently flooded soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments
Landform: Flood-plain steps (fig. 78)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 1 to 10 percent, east to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	80-90
Litter <5mm:	5-10
Rock Fragments:	0-1
Bare Soil:	1-8
Cyanobacteria Crust:	0-1
Lichen Crust:	0-1
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: Greater than 20 in/hr (very rapid)
Available water capacity total inches: about 4.3 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: frequent, very brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semiwet Fresh Streambank (Fremont Cottonwood)
Ecological site number: R035XY013UT
Present vegetation (in most areas): Fremont cottonwood, desert saltgrass, sand dropseed, rubber rabbitbrush, horsetail
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
588,594 meters E, 4231,336 meters N, zone 12.

Figure 78.—Landscape of Mido family soil, frequently flooded, component of map unit 105 (Mido-Mido family, frequently flooded, complex, 1 to 15 percent slopes).

A—0 to 4 inches (0 to 10 cm); reddish brown (5YR 5/4) sand, reddish brown (5YR 4/4), moist; 1 percent clay; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common medium roots throughout; many very fine and fine irregular pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

C1—4 to 22.5 inches (10 to 57 cm); yellowish red (5YR 5/6) coarse sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine and common fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

C2—22.5 to 39.5 inches (57 to 100 cm); yellowish red (5YR 5/6) sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common very fine, medium, and coarse roots throughout; many very fine and common fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

C3—39.5 to 71 inches (100 to 180 cm); yellowish red (5YR 5/6) coarse sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and

nonplastic; common very fine and fine roots throughout; common very fine and fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0.

Range in Characteristics

This soil is mapped at the family level because it is found on flood-plain steps, experiences frequent flooding, and is fluvial in origin.

A horizon
Hue: 5YR, 7.5YR
Chroma: 4 or 6, dry or moist
Texture: sand, fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

Upper C horizons (above 50 cm)
Texture: coarse sand, sand, fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

Lower C or 2C horizons (below 50 cm)
Texture: sand, coarse sand, fine sand
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 10 percent gravel

106—Monue-Trail-Nepalto complex, 1 to 6 percent slopes

Map Unit Setting

General setting: The River and Island in the Sky Districts, Canyonlands National Park
Elevation: 3,830 to 4,760 feet (1,167 to 1,452 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Trail and similar soils: 30 percent
Monue and similar soils: 30 percent
Nepalto and similar soils: 25 percent
Minor Components:
- Aneth soils–Desert Sand (Sand Sagebrush)
- Jeddito family soils–Desert Loam (Shadscale)

Map unit note: This map unit occurs along the Green and Colorado Rivers above map unit 96. The Monue component is on the terrace above map unit 96, and has evidence of rare flooding from high water on the river. The Trail component is on the alluvial flats above Monue, and also experiences rare river flooding. The Nepalto component is higher still on the landscape, and borders the colluvial slopes of map unit 45 at the base of the canyon walls. Flooding on this component is more likely to be from flash floods from the side canyons than to be from high water in the river.

Soil Properties and Qualities

Monue soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Typic Haplocambids (fig. 79)
Landform: Stream terraces (fig. 80)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone
Slope: 1 to 6 percent, east to west aspects

Ground Cover:	(% Cover)
Plant Canopy:	50-60
Litter <5mm:	1-5
Rock Fragments:	0
Bare Soil:	30-40
Cyanobacteria Crust:	0
Lichen Crust:	0
Moss Crust:	5-10

Figure 79.—Profile of Monue soil in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes). Scale is in centimeters.

Figure 80.—Landscape of Monue soil in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes).

Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 6.2 (moderate)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: rare, very brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: low
Hydrologic group: A
Calcium carbonate maximum: about 20 percent
Gypsum maximum: none
Salinity maximum: about 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: about 20 SAR (moderately sodic)
Ecological site name: Alkali Bottom (Greasewood)
Ecological site number: R035XY003UT
Present vegetation (in most areas): sand dropseed, greasewood, seepweed, fourwing saltbush, Indian ricegrass, Russian thistle
Land capability (non irrigated): 7c

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
585,363 meters E, 4256,242 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); reddish brown (5YR 5/4) loamy very fine sand, reddish brown (5YR 4/4), moist; 5 percent clay; weak fine subangular blocky and moderate thick platy structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots throughout; common very fine and few fine irregular pores; slightly effervescent, 6 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

Bw—4.5 to 31.5 inches (11 to 80 cm); reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4), moist; 13 percent clay; weak thick platy and weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine, and few medium roots throughout; common very fine and fine tubular pores; strongly effervescent, 14 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C—31.5 to 60 inches (80 to 152 cm); reddish brown (5YR 4/4) gravelly sand, dark reddish brown (5YR 3/4), moist; 1 percent clay; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine and fine irregular pores; 15 percent gravel; slightly effervescent, 16 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

A horizon
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Clay content: 5 to 12 percent
- Texture: loamy very fine sand, loamy fine sand, very fine sandy loam
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 0 to 5 percent gravel

Bw horizon
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: very fine sandy loam, fine sandy loam
- Clay content: 10 to 15 percent
- Calcium carbonate equivalent: 10 to 15 percent
- Rock fragments: 0 to 10 percent gravel

C horizons
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Texture: sand, loamy sand, loamy fine sand
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 10 to 20 percent
- Rock fragments: 0 to 30 percent gravel

Trail soils

Taxonomic classification: Sandy, mixed, mesic Typic Torrifluvents
Landform: Alluvial flats (fig. 81)
Geology: Alluvium (Quaternary)
Parent material: alluvium derived from sandstone and/or slope alluvium derived from sandstone
Slope: 1 to 6 percent, northeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	15-20
Litter <5mm:	20-30
Rock Fragments:	1-5
Bare Soil:	45-55

Cyanobacteria Crust:	1-5
Lichen Crust:	0
Moss Crust:	0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 5.6 (moderate)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: rare, very brief
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY118UT
Present vegetation (in most areas): seepweed, fourwing saltbush, plains pricklypear, Russian thistle
Land capability (non irrigated): 7s

Figure 81.—Landscape of Trail soil component in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes).

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
585,353 meters E, 4256,291 meters N, zone 12.

A—0 to 3 inches (0 to 7 cm); reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4), moist; 6 percent clay; moderate medium platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

Bw—3 to 15.5 inches (7 to 40 cm); reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4), moist; 7 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

C1—15.5 to 43.5 inches (40 to 110 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 6 percent clay; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

C2—43.5 to 71 inches (110 to 180 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 6 percent clay; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

A horizon
Value: 4 or 5 dry, 3 or 4 moist
Clay content: 5 to 10 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

Bw horizon
Value: 4 or 5 dry, 3 or 4 moist
Texture: stratified loamy fine sand, loamy sand
Clay content: 5 to 10 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel

C horizons
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist
Texture: stratified coarse sand, sand, fine sand, loamy fine sand
Clay content: 1 to 10 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 10 percent gravel

Bw is too coarse to qualify as a cambic horizon.

Nepalto soils

Taxonomic classification: Sandy-skeletal, mixed, mesic Typic Torriorthents (figs. 82, 83)
Landform: Alluvial flats (figs. 84, 85)
Geology: Alluvium (Quaternary)
Parent material: slope alluvium derived from sandstone

Slope: 1 to 6 percent, north to east aspects

Ground Cover:	(% Cover)
Plant Canopy:	30-40
Litter <5mm:	3-8
Rock Fragments:	8-12
Bare Soil:	45-55
Cyanobacteria Crust:	0
Lichen Crust:	0
Moss Crust:	0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 1.9 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: very rare, extremely brief
Ponding hazard: none

Figure 82.—Profile of Nepalto soil in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes). Scale is in centimeters.

Figure 83.—Profile of Nepalto soil in cut bank showing alluvial (water-borne) stratification.

Figure 84.—Landscape of Nepalto soil component in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes).

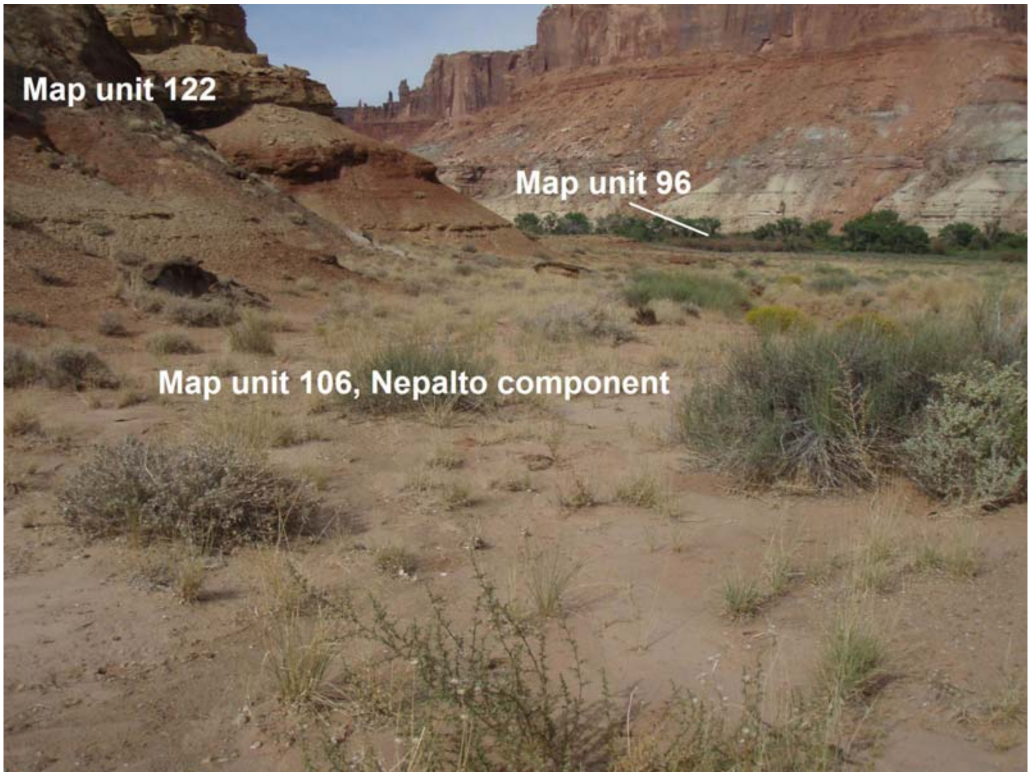


Figure 85.—Landscape of Nepalto soil in map unit 106 (Monue-Trail-Nepalto complex, 1 to 6 percent slopes) showing position map units 122 (Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery) and 96 (Green River family-Bebeevar complex, 0 to 6 percent slopes).

Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Stony Loam (Shadscale-Bud Sagebrush)
Ecological site number: R035XY136UT
Present vegetation (in most areas): sand sagebrush, shadscale saltbush, Indian ricegrass, sand dropseed, Torrey Mormon tea, galleta
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
586,687 meters E, 4259,162 meters N, zone 12.

C1—0 to 3.5 inches (0 to 9 cm); reddish brown (5YR 5/4) sand, reddish brown (5YR 4/4), moist; 4 percent clay; single grain; loose, nonsticky and nonplastic; common very fine roots throughout; many very fine interstitial pores; 5 percent gravel; strongly effervescent, 6 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C2—3.5 to 10 inches (9 to 25 cm); reddish brown (5YR 5/4) very gravelly sand, reddish brown (5YR 4/4), moist; 4 percent clay; single grain; loose, nonsticky and

nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent gravel; strongly effervescent, 6 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C3—10 to 60 inches (25 to 152 cm); reddish brown (5YR 5/4) very gravelly sand, reddish brown (5YR 4/4), moist; 4 percent clay; single grain; loose, nonsticky and nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent gravel; strongly effervescent, 6 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Range in Characteristics

C1 horizon
- Value: 4 or 5, dry or moist
- Clay content: 2 to 8 percent
- Texture: sand, loamy sand
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 0 to 5 percent gravel

C2 and C3 horizons
- Value: 4 or 5, dry or moist
- Texture: sand, loamy sand
- Clay content: 2 to 8 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 35 to 70 percent gravel and cobbles

107—Pensom-Mido complex, 2 to 30 percent slopes

Map Unit Setting

General setting: Island in the Sky, The Maze, and The Needles, and Horseshoe Canyon Districts, Canyonlands National Park (fig. 86)
Elevation: 4,840 to 6,290 feet (1,476 to 1,918 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Pensom and similar soils: 45 percent
Mido and similar soils: 40 percent
Minor Components:
- Arches soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Other deep sandy soils–Semidesert Sand (Blackbrush) and Semidesert Sand (Dune)

Soil Properties and Qualities

Pensom soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments
Landform: Dunes and sandsheets on mesas
Geology: Eolian sand and dune sand (Quaternary)
Parent material: eolian sands derived from sandstone
Slope: 2 to 15 percent, north to northwest aspects

Figure 86.—Landscape of map unit 107 (Pensom-Mido complex, 2 to 30 percent slopes) on Island in the Sky.

Ground Cover:	(% Cover)
Plant Canopy:	50-60
Litter <5mm:	3-8
Rock Fragments:	0-5
Bare Soil:	35-45
Cyanobacteria Crust:	0-10
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 2.5 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)

Ecological site number: R035XY212UT
Present vegetation (in most areas): sand dropseed, Indian ricegrass, needle and thread, sandhill muhly, Cutler Mormon tea, plains pricklypear, gooseberryleaf globemallow
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
597,300 meters E, 4249,437 meters N, zone 12.

A—0 to 4 inches (0 to 10 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; noneffervescent, 0 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear wavy boundary.
C1—4 to 19.5 inches (10 to 50 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; many fine interstitial pores; noneffervescent, 0 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear wavy boundary.
C2—19.5 to 35.5 inches (50 to 90 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; many fine interstitial pores; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.
C3—35.5 to 41.5 inches (90 to 105 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 7 percent clay; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots throughout; many fine irregular pores; carbonate, finely disseminated throughout; 1 percent gravel; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.
2R—41.5 to 51 inches (105 to 130 cm); hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 4 or 5, dry or moist
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 0 to 2 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

C horizons
Value: 4 or 5, dry or moist
Texture: fine sand, loamy fine sand
Clay content: 1 to 7 percent
Calcium carbonate equivalent: 0 to 5 percent
Rock fragments: none
Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

Mido soils
Taxonomic classification: Mixed, mesic Ustic Torripsamments (fig. 87)
Landform: Dunes and sandsheets on mesas
Geology: Eolian sand and dune sand (Quaternary)

Parent material: eolian sands derived from sandstone
Slope: 2 to 30 percent, north to northwest aspects
Ground Cover: (% Cover)

Plant Canopy:	50-60
Litter <5mm:	3-8
Rock Fragments:	0-5
Bare Soil:	35-45
Cyanobacteria Crust:	0-10
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): greater than 60 inches
Drainage class: excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 4.7 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none

Figure 87.—Profile of Mido soil in map unit 107 (Pensom-Mido complex, 2 to 30 percent slopes). Scale is in centimeters.

Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very low
Hydrologic group: A
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Sand (Fourwing Saltbush)
Ecological site number: R035XY212UT
Present vegetation (in most areas): sand dropseed, Indian ricegrass, needle and thread, sandhill muhly, Cutler Mormon tea, plains pricklypear, gooseberryleaf globemallow
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
594,721 meters E, 4253,599 meters N, zone 12.

A—0 to 3 inches (0 to 7 cm); yellowish red (5YR 5/6) fine sand, reddish brown (5YR 4/4), moist; 1 percent clay; weak fine subangular blocky and moderate thick platy structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; noneffervescent, 0 percent calcium carbonate equivalent; slightly alkaline, pH 7.4; clear wavy boundary.

C1—3 to 16 inches (7 to 41 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 2 percent clay; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; noneffervescent, 0 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear smooth boundary.

BC—16 to 27 inches (41 to 69 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; moderate fine and weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine irregular pores; common fine carbonate nodules in matrix; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C2—27 to 78.5 inches (69 to 200 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common fine roots throughout; common very fine interstitial pores; common fine carbonate nodules in matrix; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4.

Range in Characteristics

A horizon
- Chroma: 4 or 6, dry or moist
- Clay content: 1 to 5 percent
- Calcium carbonate equivalent: 0 to 2 percent
- Rock fragments: none
- Reaction: slightly alkaline or moderately alkaline (7.4 to 8.4)

BC and C horizons
- Texture: fine sand, loamy fine sand
- Clay content: 1 to 7 percent
- Calcium carbonate equivalent: 0 to 5 percent
- Rock fragments: none

108—Reef-Rock outcrop complex, 2 to 30 percent slopes

Map Unit Setting

General setting: The Maze and The Needles Districts, Canyonlands National Park
Elevation: 5,120 to 6,740 feet (1,561 to 2,055 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Reef and similar soils: 60 percent
Rock outcrop, Organ Rock Formation Shale: 15 percent
Minor Components:
- Other shallow soils–Semidesert Shallow Sandy loam (Utah Juniper/Blackbrush)
- Rizno soils–Semidesert Shallow Sandy loam (Utah Juniper/Blackbrush)
- Rock outcrop (Cedar Mesa Formation sandstone)

Soil Properties and Qualities

Reef soils
Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 88)
Landform: Structural benches, mesas (fig. 89)
Geology: Organ Rock Formation Shale (Permian) and Moenkopie Formation Sandstone (Triassic)
Parent material: residuum weathered from sandstone and shale
Slope: 2 to 30 percent, east to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	25-30
Litter <5mm:	3-8
Rock Fragments:	20-30
Bare Soil:	5-10
Cyanobacteria Crust:	8-12
Lichen Crust:	10-20
Moss Crust:	3-8
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 17 inches to bedrock, paralithic; 4 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.2 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 40 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)

Ecological site name: Semidesert Very Shallow Gravelly Loam (Utah Juniper)
Ecological site number: R035XY235UT
Present vegetation (in most areas): blackbrush, Utah juniper, pinyon, roundleaf buffaloberry, galleta, rubber rabbitbrush
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
589,256 meters E, 4226,846 meters N, zone 12.

C—0 to 4 inches (0 to 10 cm); light red (2.5YR 7/6) very gravelly coarse sandy loam, red (2.5YR 5/6), moist; 10 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine roots throughout; common very fine irregular pores; 50 percent gravel; strongly effervescent, 15 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.
Cr—4 to 4.5 inches (10 to 12 cm); few very fine roots in cracks; soft Organ Rock Formation shale bedrock; abrupt wavy boundary.
R—4.5 to 14.5 inches (12 to 37 cm); few fine roots top of horizon; hard Organ Rock Formation shale bedrock.

Range in Characteristics

C horizon
Value: 4 to 7, dry, 4 or 5, moist
Chroma: 4 or 6, dry or moist
Texture: coarse sandy loam, sandy loam

Figure 88.—Profile of Reef soil in map unit 108 (Reef-Rock outcrop complex, 2 to 30 percent slopes). Lithic contact is at 12 centimeters. Scale is in centimeters.

Figure 89.—Landscape of map unit 108 (Reef-Rock outcrop complex, 2 to 30 percent slopes) in the Maze District.

Clay content: 9 to 14 percent
Calcium carbonate equivalent: 5 to 15 percent
Rock fragments: 30 to 60 percent gravel or channers
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Rock outcrop, Organ Rock Formation shale
This component is characterized by gently rolling bedrock, as well as by many cliffs, spires, and escarpments. The lithology is shale, siltstone, and sandstone. Slopes generally range from 8 to 100 percent or greater. The vertical relief of the cliffs and spires ranges from from a few feet to several tens of feet and can be nearly continuous (fig. 90). Typically, the steepness, vertical relief, and continuity of cliffs are such to make travel by full-sized four-wheeled vehicles virtually impossible in some areas, whereas other areas are easily negotiated by vehicles. Travel by foot is difficult and strenuous on the steeper parts of this component, and much easier in areas that are less steep. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

109—Reef-Rock outcrop complex, 30 to 60 percent slopes, extremely bouldery

Map Unit Setting

General setting: The Maze, The Needles, and Horseshoe Canyon Districts, Canyonlands National Park (fig. 91)
Elevation: 4,480 to 7,190 feet (1,366 to 2,191 meters)

Figure 90.— An example of nearly vertical rock outcrop in map unit 108 (Reef-Rock outcrop complex, 2 to 30 percent slopes).

Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Reef and similar soils: 65 percent
Rock outcrop, Organ Rock and Moenkopie Formations: 30 percent
Minor Components:
- Mathis family soils–Semidesert Very Steep Stony Loam (Utah Juniper-Pinyon)

Map unit note: The inclusion of the term “extremely bouldery” in the map unit name indicates the common presence of boulders on the surface of the soil, which could impact use and management.

Soil Properties and Qualities

Reef soils

Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 92)
Landform: Talus slopes
Geology: Organ Rock Formation shale (Permian) and Moenkopie Formation sandstone (Triassic)
Parent material: colluvium derived from sandstone
Slope: 30 to 60 percent, northeast to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	1-5
Rock Fragments:	50-60

Bare Soil:	5-10
Cyanobacteria Crust:	0-1
Lichen Crust:	0-1
Moss Crust:	0-1
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 0.4 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Very Steep Stony Loam (Pinyon-Utah Juniper)
Ecological site number: R035XY263UT
Present vegetation (in most areas): singleleaf ash, Utah juniper, Utah serviceberry, desert princesplume, sumac, desert needlegrass
Land capability (non irrigated): 7s

Figure 91.—Landscape of map unit 109 (Reef-Rock outcrop complex, 30 to 60 percent slopes, extremely bouldery) in the Maze District.

Figure 92.—Profile of Reef soil in map unit 109 (Reef-Rock outcrop complex, 30 to 60 percent slopes, extremely bouldery). Fractured lithic contact begins at 10 centimeters, with roots present in cracks; at 33 centimeters, bedrock is less fractured.

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
586,386 meters E, 4232,074 meters N, zone 12.

C—0 to 4 inches (0 to 10 cm); reddish brown (5YR 4/4) very channery loam, dark reddish brown (5YR 3/4), moist; 15 percent clay; massive; slightly hard, friable, moderately sticky and slightly plastic; common very fine and fine roots throughout; many very fine and common fine interstitial pores; 50 percent channers; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

R1—4 to 13 inches (10 to 33 cm); common fine roots in cracks; hard fractured Moenkopie Formation sandstone bedrock.

R2—13 to 23 inches (33 to 58 cm); common medium roots top of horizon; hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

C horizon
Hue: 2.5YR, 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 3 or 4, dry or moist
Texture: loam, fine sandy loam
Clay content: 8 to 18 percent

Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 35 to 75 percent channers

Rock outcrop, Organ Rock and Moenkopie Formations
This component is characterized by many cliffs and escarpments with very steep colluvial and talus slopes. The lithology is shale, siltstone, and sandstone. Slopes generally range from 35 to 100 percent. The vertical relief of the cliffs is from a few feet to several tens of feet and can be nearly continuous. Rockfall, boulders, and stones dominate the surface. Typically, the steepness, vertical relief, and continuity of cliffs make travel by full-sized four-wheeled vehicles virtually impossible. Travel by foot is difficult and strenuous. This component is usually a natural barrier to livestock and to many terrestrial animals.

110—Rizno-Ignacio complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Needles District, Canyonlands National Park
Elevation: 4,630 to 5,520 feet (1,410 to 1,684 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rizno and similar soils: 50 percent
Ignacio and similar soils: 35 percent
Minor Components:
- Sazi soils–Semidesert Sandy Loam (Blackbrush)
- Other shallow soils–Semidesert Shallow Sandy Loam (Blackbrush) and Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Rock outcrop (Cedar Mesa Formation sandstone)

Soil Properties and Qualities

Rizno soils
Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 93)
Landform: Mesas (fig. 94)
Geology: Cedar Mesa Formation sandstone (Permian)
Parent material: eolian deposits derived from sandstone
Slope: 2 to 15 percent, northeast to east aspects

Ground Cover:	(% Cover)
Plant Canopy:	30-40
Litter <5mm:	3-8
Rock Fragments:	0-5
Bare Soil:	10-15
Cyanobacteria Crust:	5-10
Lichen Crust:	25-30
Moss Crust:	8-12
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained

Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.7 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): blackbrush, Utah juniper, singleleaf ash, galleta, broom snakeweed, twoneedle pinyon
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
607,552 meters E, 4226,202 meters N, zone 12.

A—0 to 2.5 inches (0 to 6 cm); brown (7.5YR 4/4) very fine sand, dark brown (7.5YR 3/4), moist; 4 percent clay; weak fine and medium granular structure; soft, very

Figure 93.—Profile of Rizno soil in map unit 110 (Rizno-Ignacio complex, 2 to 15 percent slopes). Lithic contact is at 17 centimeters. Scale is in centimeters.

Figure 94.—Landscape of Rizno soil component in map unit 110 (Rizno-Ignacio complex, 2 to 15 percent slopes) in the Needles District.

friable, nonsticky and nonplastic; common fine roots throughout; common fine irregular pores; 2 percent fine gravel; very slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear smooth boundary.

Bw—2.5 to 6.5 inches (6 to 16 cm); reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4), moist; 10 percent clay; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots throughout; common fine irregular pores; 10 percent channers; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt smooth boundary.

2R—6.5 to 16 inches (16 to 41 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sandy loam, loamy fine sand, very fine sand
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 0 to 5 percent gravel

C horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sandy loam, very fine sandy loam, loamy very fine sand
- Calcium carbonate equivalent: 1 to 5 percent

Rock fragments: 0 to 15 percent gravel or channers

Ignacio soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids (fig. 95)
Landform: Mesas (fig. 96)
Geology: Eolian sand and slope alluvium (Quaternary)
Parent material: eolian deposits derived from sandstone
Slope: 2 to 15 percent, northeast to southeast aspects

Ground Cover:	(% Cover)
Plant Canopy:	50-75
Litter <5mm:	5-10
Rock Fragments:	0-5
Bare Soil:	10-15
Cyanobacteria Crust:	15-20
Lichen Crust:	3-8
Moss Crust:	3-8
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 3.1 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches

Figure 95. Landscape of Ignacio soil component in map unit 110 (Rizno-Ignacio complex, 2 to 15 percent slopes) in the Needles District.

Figure 96. Profile of Ignacio soil in map unit 110 (Rizno-Ignacio complex, 2 to 15 percent slopes). Lithic contact is at 57 centimeters (not visible in this photo. Scale is in centimeters.

Runoff class: high
Hydrologic group: C
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Semidesert Sandy Loam (Fourwing Saltbush)
Ecological site number: R035XY215UT
Present vegetation (in most areas): Indian ricegrass, sand dropseed, blue grama, Cutler Mormon tea, fourwing saltbush
Land capability (non irrigated): 6c

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
605,971 meters E, 4225,588 meters N, zone 12.

A—0 to 3 inches (0 to 7 cm); reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4), moist; 17 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common fine roots throughout; many fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.
Bw—3 to 22.5 inches (7 to 57 cm); reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4), moist; 15 percent clay; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; strongly effervescent, 4 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; abrupt wavy boundary.
2R—22.5 to 32.5 inches (57 to 82 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 4 to 6, dry or moist
Texture: fine sandy loam, loamy fine sand
Clay content: 6 to 18 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel

Bw horizon
Hue: 5YR, 7.5YR
Value: 4 or 5, dry or moist
Chroma: 4 or 6, dry or moist
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

111—Rizno-Rock outcrop complex, 1 to 25 percent slopes

Map Unit Setting

General setting: Island in the Sky and The Maze Districts, Canyonlands National Park (fig. 97)
Elevation: 4,510 to 6,400 feet (1,376 to 1,952 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rizno and similar soils: 60 percent
Rock outcrop, Kayenta Formation sandstone: 20 percent
Minor Components:
- Batterson soils–Semidesert Shallow Sandy Loam (Blackbrush)
- Mido soils–Semidesert Sand (Blackbrush)
- Soils on steep slopes–Semidesert Very Steep Stony Loam (Utah Juniper/Pinyon) and Semidesert Very Steep Stony Loam (Salina wildrye)
- Shallow soils in areas of higher rock outcrop–Shallow Sand Rock Pocket (Utah Juniper/Pinyon)

Soil Properties and Qualities

Rizno soils

Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 98)
Landform: Mesas, structural benches
Geology: Kayenta Formation sandstone (Triassic)
Parent material: residuum weathered from sandstone
Slope: 1 to 25 percent, north to northwest aspects
Ground Cover: (% Cover)

Plant Canopy:	15-25
Litter <5mm:	1-5
Rock Fragments:	1-10
Bare Soil:	5-10
Cyanobacteria Crust:	10-15
Lichen Crust:	50-75
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 17 inches to bedrock, paralithic; 5 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.4 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high

Figure 97.—Landscape of map unit 111 (Rizno-Rock outcrop complex, 1 to 25 percent slopes) on Island in the Sky.

Hydrologic group: D
Calcium carbonate maximum: about 15 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): blackbrush, Utah juniper, twoneedle pinyon, broom snakeweed, green Mormon tea, plains pricklypear
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
601,921 meters E, 4260,803 meters N, zone 12.

A—0 to 2 inches (0 to 5 cm); yellowish red (5YR 5/6) gravelly sandy loam, yellowish red (5YR 4/6), moist; 10 percent clay; weak medium granular and weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common fine irregular pores; 25 percent gravel; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

Bw—2 to 4 inches (5 to 10 cm); reddish yellow (5YR 6/6) channery sandy loam, yellowish red (5YR 4/6), moist; 16 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots

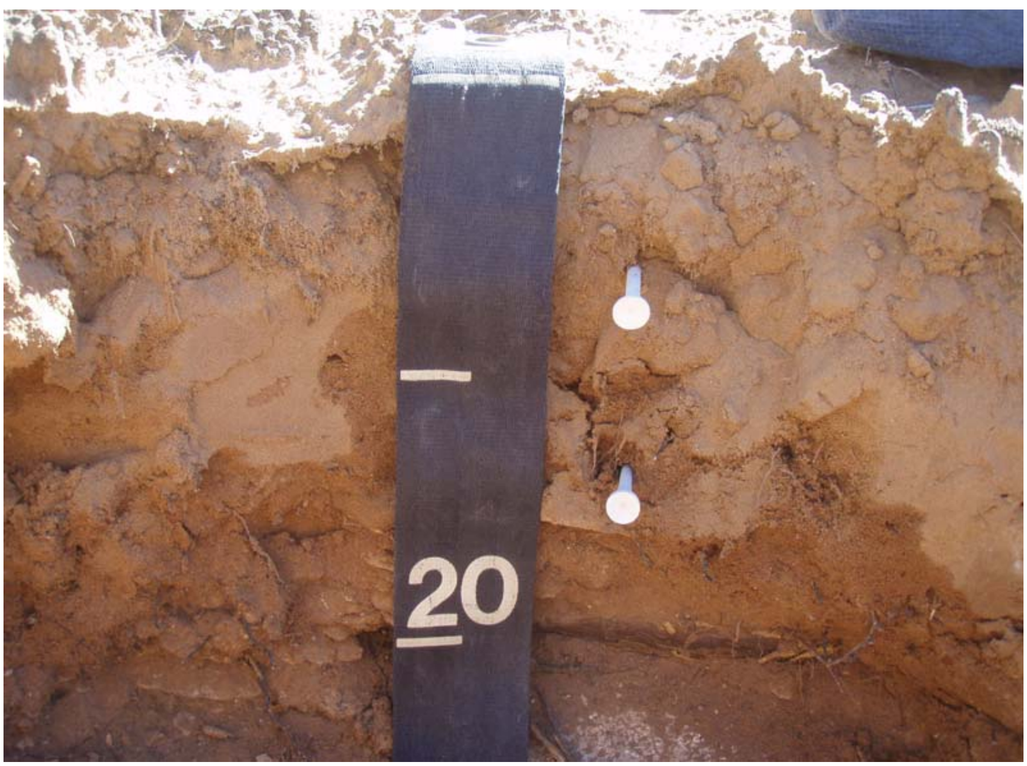


Figure 98.—Profile of Rizno soil in map unit 111 (Rizno-Rock outcrop complex, 1 to 25 percent slopes). Lithic contact is at 23 centimeters. Scale is in centimeters.

throughout; common fine irregular pores; carbonate, finely disseminated throughout; 15 percent channers; violently effervescent, 10 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

Cr—4 to 5.5 inches (10 to 14 cm); soft Kayenta Formation sandstone bedrock; very abrupt wavy boundary.

R—5.5 to 15.5 inches (14 to 39 cm); hard Kayenta Formation sandstone bedrock.

Range in Characteristics

A horizon
- Hue: 2.5YR, 5YR
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Texture: sandy loam, loamy coarse sand, loamy sand
- Clay content: 8 to 15 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 5 to 30 percent gravel or channers

Bw or C horizon
- Hue: 2.5YR, 5YR
- Value: 4 to 6 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Clay content: 10 to 18 percent
- Calcium carbonate equivalent: 5 to 15 percent
- Rock fragments: 10 to 30 percent channers or gravel

Rock outcrop, Kayenta Formation sandstone

This component is characterized by nearly level to strongly sloping rock outcrop with discontinuous short escarpments. Slopes generally range from 2 to 45 percent. The lithology is sandstone. The vertical relief is usually a few feet, and the continuity of the escarpments is broken. Typically, there are enough escarpments to impede vehicular travel to some degree. The area can be negotiated by full-sized four-wheeled vehicles with difficulty. There are no impediments to foot travel or to the movement of animals. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain (fig. 99).

112—Rizno-Rock outcrop complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Maze, The Needles, and Island in the Sky Districts, Canyonlands National Park (fig. 100)
Elevation: 5,150 to 6,990 feet (1,571 to 2,131 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rizno and similar soils: 40 percent
Rock outcrop, Chinle Formation, Shinarump Member: 25 percent
Minor Components:
- Reef taxadjunct soils–Semidesert Shallow Loam (Utah Juniper/Pinyon)

Figure 99.—Rain-filled potholes in Kayenta Formation sandstone, map unit 111 (Rizno-Rock outcrop complex, 1 to 25 percent slopes).

- Batterson soils–Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
- Mathis family soils–Semidesert Sand (Blackbrush)
- Ignacio family soils–Semidesert Sandy Loam (Blackbrush)

Soil Properties and Qualities

Rizno soils

Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 101)
Landform: Mesas
Geology: Eolian Sand (Quaternary) and Shinarump Conglomerate Member of Chinle Formation (Triassic)
Parent material: eolian deposits derived from sandstone
Slope: 2 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	20-40
Litter <5mm:	10-20
Rock Fragments:	5-15
Bare Soil:	5-15
Cyanobacteria Crust:	20-30
Lichen Crust:	2-4
Moss Crust:	0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained

Figure 100.—Landscape of map unit 112 (Rizno-Rock outcrop complex, 2 to 15 percent slopes).

Figure 101.—Profile of Rizno soil in map unit 112 (Rizno-Rock outcrop complex, 2 to 15 percent slopes). Lithic contact is at 10 centimeters. Scale is in centimeters.

Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.8 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush)
Ecological site number: R035XY236UT
Present vegetation (in most areas): Utah juniper, twoneedle pinyon, broom snakeweed, fourwing saltbush, Mormon tea, cliffrose, plains pricklypear
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
583,212 meters E, 4224,852 meters N, zone 12.

A—0 to 1 inch (0 to 3 cm); reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4), moist; 12 percent clay; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine roots throughout; many very fine irregular pores; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

C—1 to 5.5 inches (3 to 14 cm); reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4), moist; 14 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots throughout; many very fine irregular pores; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

2R—5.5 to 15.5 inches (14 to 39 cm); hard Chinle Formation, Shinarump Member sandstone bedrock.

Range in Characteristics

A horizon
Value: 4 or 5, dry or moist
Texture: fine sandy loam, very fine sandy loam
Clay content: 8 to 12 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 5 percent gravel

C horizon
Value: 5 or 6 dry
Texture: sandy loam, fine sandy loam, very fine sandy loam
Clay content: 10 to 15 percent
Calcium carbonate equivalent: 3 to 5 percent
Rock fragments: 0 to 5 percent gravel

Rock outcrop, Chinle Formation, Shinarump Member
This component is characterized by nearly level to gently sloping rock outcrop. The

lithology is sandstone and conglomerate. Slopes generally range from 2 to 15 percent. Typically, there are very few cliffs or escarpments to impede travel. The vertical relief is usually less than a few feet. The area can usually be easily negotiated by four-wheeled vehicles. There are no impediments to foot travel or to the movement of animals. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

113—Rock outcrop-Arches complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Needles and The Maze Districts, Canyonlands National Park (fig. 102)
Elevation: 4,250 to 6,650 feet (1,294 to 2,028 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rock outcrop, Cedar Mesa sandstone: 65 percent
Arches and similar soils: 25 percent

Figure 102.—Landscape of map unit 113 (Rock outcrop-Arches complex, 2 to 15 percent slopes) in the Maze District.

Minor Components:
- Rizno soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Mido soils–Semidesert Sand (Blackbrush)

Soil Properties and Qualities

Rock outcrop, Cedar Mesa sandstone

This component is characterized by nearly level to gently sloping rock outcrop. The lithology is sandstone. Slopes generally range from 2 to 30 percent. Typically, there are very few cliffs or escarpments to impede travel. The vertical relief is usually less than a few feet. The area can usually be easily negotiated by four-wheeled vehicles. There are no impediments to foot travel or to the movement of animals. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

Arches soils

Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 103)
Landform: Mesas, structural benches
Geology: Cedar Mesa Formation sandstone (Permian)
Parent material: eolian sands
Slope: 2 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	35-40
Litter <5mm:	1-5
Rock Fragments:	50-60
Bare Soil:	5-10
Cyanobacteria Crust:	0-1
Lichen Crust:	0-1

Figure 103.—Profile of Arches soil in map unit 113 (Rock outcrop-Arches complex, 2 to 15 percent slopes). Lithic contact is at 25 centimeters. Scale is in centimeters.

Moss Crust:	0-1
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 1.1 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
Ecological site number: R035XY019UT
Present vegetation (in most areas): pinyon, littleleaf mountain-mahogany, Utah juniper, blackbrush, needle and thread, singleleaf ash, galleta, purple threeawn
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
589,276 meters E, 4229,271 meters N, zone 12.

AC—0 to 8.5 inches (0 to 22 cm); pink (7.5YR 7/3) fine sand, brown (7.5YR 5/3), moist; 1 percent clay; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots throughout; common very fine and few fine tubular pores; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

C—8.5 to 19 inches (22 to 48 cm); light brown (7.5YR 6/3) fine sand, brown (7.5YR 4/4), moist; 3 percent clay; single grain; loose, nonsticky and nonplastic; few very fine, fine, and medium roots throughout; many very fine interstitial pores; 2 percent gravel; strongly effervescent, 3 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; abrupt wavy boundary.

2R—19 to 28.5 inches (48 to 73 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

AC horizon
Chroma: 3 to 6, dry or moist
Texture: fine sand, loamy sand
Clay content: 0 to 6 percent
Calcium carbonate equivalent: 0 to 1 percent
Rock fragments: 0 to 5 percent channers or gravel

C or C2 horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 to 8 dry, 4 or 6 moist
Texture: fine sand, loamy sand

Clay content: 0 to 8 percent
Calcium carbonate equivalent: 0 to 5 percent
Rock fragments: 0 to 5 percent channers or gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

114—Rock outcrop-Arches complex, 2 to 60 percent slopes

Map Unit Setting

General setting: The Needles and The Maze Districts, Canyonlands National Park (fig. 104)
Elevation: 4,290 to 6,840 feet (1,309 to 2,084 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rock outcrop, Cedar Mesa sandstone: 80 percent
Arches and similar soils: 15 percent
Minor Components:
- Colluvial soils on steep slopes–Semidesert Very Steep Stony Loam (Utah Juniper/Pinyon)
- Rizno soils–Semidesert Shallow Sandy Loam (Utah Juniper/Blackbrush)

Figure 104.—Landscape of map unit 114 (Rock outcrop-Arches complex, 2 to 60 percent slopes).

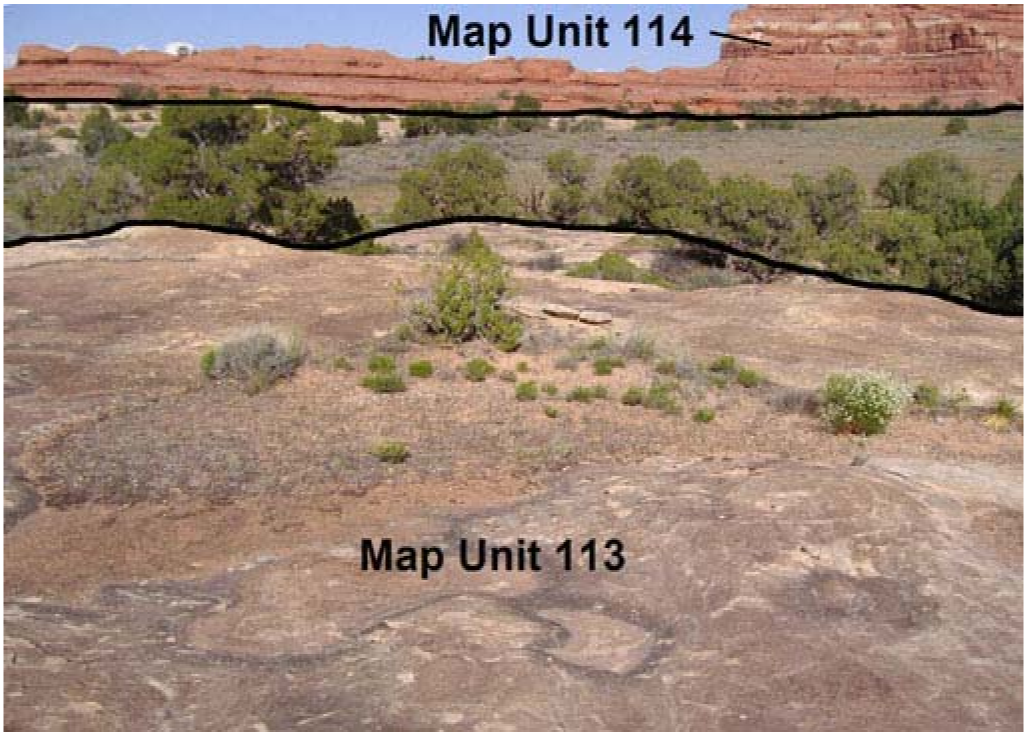


Figure 105.—Photo illustrating the slope difference between the rock outcrop components in map units 113 (Rock outcrop-Arches complex, 2 to 15 percent slopes) and 114 (Rock outcrop-Arches complex, 2 to 60 percent slopes).

Soil Properties and Qualities

Rock outcrop, Cedar Mesa sandstone

This component is characterized by landscapes that range from gently sloping to nearly vertical rock outcrop (fig. 105). The lithology is sandstone. Slopes generally range from 2 to 100 percent. The vertical relief ranges from a few feet to several tens of feet, and the continuity of steep areas ranges from broken to nearly continuous. Typically, the area is steep enough and there are enough nearly vertical areas to make travel by full-sized four-wheeled vehicles very difficult. This component can be a natural barrier to livestock and most terrestrial animals. The steep and nearly vertical areas are barren but there may be vegetation growing in cracks and crevices or in areas of colluvial deposition. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

Arches soils

Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 106)
Landform: Buttes, structural benches, mesas
Geology: Eolian Sand (Quaternary) and Cedar Mesa Formation sandstone (Permian)
Parent material: eolian sands derived from sandstone
Slope: 2 to 60 percent, east to south aspects

Ground Cover:	(% Cover) (fig. 107)
Plant Canopy:	10-20
Litter <5mm:	1-10
Rock Fragments:	5-10
Bare Soil:	25-30
Cyanobacteria Crust:	20-30
Lichen Crust:	1-5

Moss Crust:	1-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 0.7 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
Ecological site number: R035XY019UT
Present vegetation (in most areas): blackbrush, Utah juniper, twoneedle pinyon, broom snakeweed, Indian ricegrass, galleta, singleleaf ash
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
604,707 meters E, 4219,212 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm); brown (7.5YR 5/4) loamy fine sand, strong brown (7.5YR 5/6), moist; 4 percent clay; weak medium granular and moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots throughout; many very fine irregular pores; 3 percent gravel; slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

C—3.5 to 8.5 inches (9 to 21 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 10 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots throughout; common very fine irregular pores; 10 percent gravel; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

2R—8.5 to 18 inches (21 to 46 cm); hard Cedar Mesa Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 4 or 5, dry or moist
Chroma: 3 to 6, dry or moist
Texture: loamy fine sand, fine sand, loamy sand
Clay content: 2 to 6 percent
Calcium carbonate equivalent: 1 to 3 percent
Rock fragments: 0 to 5 percent channers or gravel

C horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist

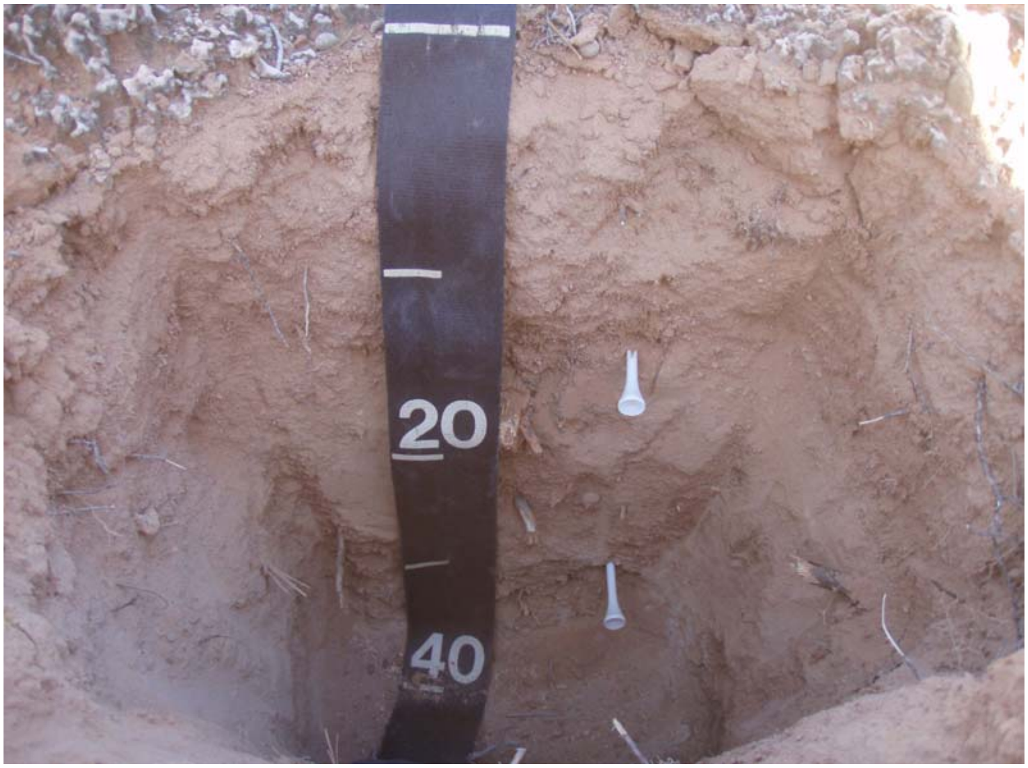


Figure 106.—Profile of Arches soil in map unit 114 (Rock outcrop-Arches complex, 2 to 60 percent slopes). Lithic contact is at 37 centimeters. Scale is in centimeters.

Figure 107.—Biological crust on surface of Arches soil in map unit 114 (Rock outcrop-Arches complex, 2 to 60 percent slopes).

Figure 108.—Landscape of map unit 115 (Rock outcrop-Nalcase complex, 2 to 15 percent slopes) on Island in the Sky.

Chroma: 3 to 8 dry, 4 or 6 moist
Texture: fine sand, loamy sand
Clay content: 2 to 10 percent
Calcium carbonate equivalent: 2 to 5 percent
Rock fragments: 0 to 10 percent channers or gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

115—Rock outcrop-Nalcase complex, 2 to 15 percent slopes

Map Unit Setting

General setting: Island in the Sky and Horseshoe Canyon Districts, Canyonlands National Park (fig. 108)
Elevation: 4,700 to 6,330 feet (1,433 to 1,929 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rock outcrop, Navajo Formation sandstone: 60 percent
Nalcase and similar soils: 25 percent

Minor Components:
- Mido family soils deeper than 20 inches to bedrock–Semidesert Sand (Dune)
- Rizno soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)

Soil Properties and Qualities

Rock outcrop, Navajo Formation sandstone
This component is characterized by gently sloping to steep rock outcrop. The lithology is sandstone. Slopes generally range from 6 to 45 percent. Typically, there are few, nearly vertical cliffs to impede vehicular travel. The vertical relief usually ranges from a few feet to several feet. Because of the steepness of slopes, the area can be negotiated by full-sized four-wheeled vehicles with care. There are no impediments to foot travel or to the movement of animals. The area is typically barren but may have vegetation growing in cracks and crevices or in thin layers of sediment covering the surface. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

Nalcase soils
Taxonomic classification: Siliceous, mesic Lithic Torripsamments (fig. 109)
Landform: Buttes, mesas
Geology: Navajo Formation sandstone (Jurassic)
Parent material: eolian sands derived from sandstone
Slope: 2 to 15 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	45-50
Litter <5mm:	0-5

Figure 109.—Soil profile of Nalcase in map unit 115 (Rock outcrop-Nalcase complex, 2 to 15 percent slopes). Lithic contact is at 12 centimeters. Scale is in centimeters.

Rock Fragments:	1-5
Bare Soil:	5-15
Cyanobacteria Crust:	25-45
Lichen Crust:	10-20
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 6 to 17 inches to bedrock, paralithic; 9 to 20 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: Greater than 20 in/hr (very rapid)
Available water capacity total inches: about 0.4 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 1 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
Ecological site number: R035XY019UT
Present vegetation (in most areas): littleleaf mountain-mahogany, twoneedle pinyon, Bigelow sagebrush, Utah juniper, bottlebrush squirreltail, broom snakeweed, purple threeawn, singleleaf ash
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
601,145 meters E, 4252,862 meters N, zone 12.

A—0 to 2 inches (0 to 5 cm); reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6), moist; 1 percent clay; weak fine subangular blocky and moderate medium platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots throughout; common very fine irregular pores; noneffervescent, 0 percent calcium carbonate equivalent; slightly alkaline, pH 7.6; abrupt smooth boundary.

C—2 to 6.5 inches (5 to 16 cm); reddish yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6), moist; 1 percent clay; single grain; loose, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine interstitial pores; noneffervescent, 0 percent calcium carbonate equivalent; slightly alkaline, pH 7.6; abrupt smooth boundary.

2Cr—6.5 to 9 inches (16 to 23 cm); soft Navajo Formation sandstone bedrock; very abrupt smooth boundary.

2R—9 to 19 inches (23 to 48 cm); hard Navajo Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Clay content: 1 to 3 percent

Calcium carbonate equivalent: 0 to 1 percent
Rock fragments: none

C horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 4 to 6, dry or moist
Clay content: 1 to 3 percent
Calcium carbonate equivalent: 0 to 1 percent
Rock fragments: none

116—Rock outcrop-Needle complex, 2 to 30 percent slopes

Map Unit Setting

General setting: White Rim region of Island in the Sky and The Maze Districts, Canyonlands National Park (fig. 110)
Elevation: 3,930 to 5,280 feet (1,197 to 1,609 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Figure 110.—Landscape of map unit 116 (Rock outcrop-Needle complex, 2 to 30 percent slopes) on the White Rim.

Map Unit Composition

Rock outcrop, White Rim Formation sandstone: 60 percent
Needle and similar soils: 35 percent
Minor Components:
- Moenkopie soils–Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
- Bluechief soils–Desert Shallow Sandy Loam (Shadscale)

Soil Properties and Qualities

Rock outcrop, White Rim sandstone
This component is characterized by gently sloping to steep rock outcrop. The lithology is sandstone. Slopes generally range from 6 to 45 percent. Typically, there are a few, nearly vertical cliffs to impede vehicular travel. The vertical relief is usually a few feet to several feet. Because of the steepness of slopes, the area can be negotiated by full-sized four-wheeled vehicles with care. There are no impediments to foot travel or to the movement of animals. The area is typically barren but may have vegetation growing in cracks and crevices or in thin layers of sediment covering the surface. Portions of this rock outcrop include potholes in which water may pond for brief periods after rain.

Needle soils
Taxonomic classification: Mixed, mesic Lithic Torripsamments (fig. 111)
Landform: Structural benches
Geology: Eolian Sand (Quaternary) and White Rim Formation sandstone (Permian)
Parent material: eolian sands derived from sandstone
Slope: 2 to 30 percent, north aspect

Figure 111.—Profile of Needle soil in map unit 116 (Rock outcrop-Needle complex, 2 to 30 percent slopes). Lithic contact is at 12 centimeters. Scale is in centimeters.

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	1-5
Rock Fragments:	5-10
Bare Soil:	25-30
Cyanobacteria Crust:	5-10
Lichen Crust:	5-10
Moss Crust:	5-10
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: excessively drained
Slowest permeability: Greater than 20 in/hr (very rapid)
Available water capacity total inches: about 0.7 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Shallow Sand Rock Pocket (Utah Juniper/Pinyon)
Ecological site number: R035XY019UT
Present vegetation (in most areas): blackbrush, singleleaf ash, Indian ricegrass, Utah juniper, broom snakeweed, galleta, twoneedle pinyon
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
602,125 meters E, 4245,992 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm); yellowish red (5YR 5/6) fine sand, reddish brown (5YR 4/4), moist; 1 percent clay; weak fine and moderate coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots throughout; common fine irregular pores; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

C—3.5 to 11.5 inches (9 to 29 cm); yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6), moist; 3 percent clay; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots throughout; common fine irregular pores; slightly effervescent, 1 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

2R—11.5 to 21.5 inches (29 to 54 cm); hard White Rim Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 5YR, 7.5YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 4 to 8, dry or moist

Clay content: 1 to 3 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: none

C horizon
Hue: 5YR, 7.5YR
Value: 5 to 7 dry, 4 or 6 moist
Chroma: 4 to 8 dry, 6 or 8 moist
Clay content: 1 to 3 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 2 percent gravel

In some pedons, there is a thin residual 2C horizon directly overlying the bedrock, which has a texture of sandy loam.

117—Rock outcrop-Torriorthents complex, 20 to 65 percent slopes, extremely bouldery

Map Unit Setting

General setting: Island in the Sky and The Maze Districts, Canyonlands National Park
Elevation: 3,910 to 5,240 feet (1,193 to 1,596 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rock outcrop, Permian: 55 percent
Torriorthents and similar soils: 45 percent
Minor Components:
- Tsaya family soils–Desert Shallow Sandy Loam (Shadscale)

Map unit note: The inclusion of the term “extremely bouldery” in the map unit name indicates the common presence of boulders on the surface of the soil, which could impact use and management.

Soil Properties and Qualities

Rock outcrop, Permian
This component is characterized by many cliffs and escarpments with very steep colluvial and talus slopes. The lithology is sandstone. Slopes generally range from 30 percent to near vertical. The vertical relief of the outcrops ranges from a few feet to hundreds of feet and is very broken. Typically, the steepness and vertical relief of rock outcrops make travel by full-sized four-wheeled vehicles virtually impossible. Travel by foot is difficult and strenuous. This component is usually a natural barrier to livestock and to many terrestrial animals.

Torriorthents soils
Taxonomic classification: Torriorthents (fig. 112)
Landform: Talus slopes (fig. 113)
Geology: Organ Rock Formation shale and Cedar Mesa Formation sandstone (Permian)
Parent material: colluvium derived from sandstone
Slope: 20 to 65 percent, east to northwest aspects

Figure 112.—Profile of Torriorthents soil in map unit 117 (Rock outcrop-Torriorthents complex, 20 to 65 percent slopes, extremely bouldery). Lithic contact is at 5 centimeters. Scale is in centimeters.

Figure 113.—Landscape of map unit 117 (Rock outcrop-Torriorthents complex, 20 to 65 percent slopes, extremely bouldery).

Ground Cover:	(% Cover) (fig. 114)
Plant Canopy:	5-15
Litter <5mm:	0-5
Rock Fragments:	50-70
Bare Soil:	10-30
Cyanobacteria Crust:	0-5
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 2 to 50 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.2 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Very Steep Stony Loam (Shadscale)

Figure 114.—Boulders at the surface of map unit 117 (Rock outcrop-Torriorthents complex, 20 to 65 percent slopes, extremely bouldery).

Ecological site number: R035XY146UT
Present vegetation (in most areas): galleta, pepperweed, skunkbush sumac, desert princesplume, Torrey Mormon tea
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
605,577 meters E, 4251,072 meters N, zone 12.

C—0 to 2 inches (0 to 5 cm); dark reddish brown (2.5YR 3/4) very gravelly sandy loam, dark reddish brown (2.5YR 2.5/3), moist; 19 percent clay; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine irregular pores; 40 percent gravel; slightly effervescent, 2 percent calcium carbonate equivalent; slightly alkaline, pH 7.4; abrupt wavy boundary.
R—2 to 12 inches (5 to 30 cm); hard Organ Rock Formation sandstone bedrock.

Range in Characteristics

This soil was mapped at the Great Group level because of variation in textures and coarse fragments, and in depth to bedrock.

C horizon
Value: 3 to 6 dry, 2.5 or 3 moist
Chroma: 3 or 4, dry or moist
Texture: sandy loam, loamy coarse sand, coarse sand
Clay content: 2 to 20 percent
Calcium carbonate equivalent: 0 to 5 percent
Rock fragments: 5 to 80 percent

118—Rock outcrop-Tsaya complex, 15 to 60 percent slopes, extremely bouldery

Map Unit Setting

General setting: White Rim region of Island in the Sky, The Needles, and The Maze Districts, Canyonlands National Park (fig. 115)
Elevation: 3,900 to 5,600 feet (1,188 to 1,708 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Rock outcrop, Moenkopie and Cutler Group sandstones: 50 percent
Tsaya and similar soils: 45 percent
Minor Components:
- Bluechief soils–Semidesert Sandy Loam (Blackbrush)
- Other shallow soils–Desert Shallow Sandy Loam (Blackbrush) and Desert Very Steep Gravelly Loam (Blackbrush)

Map unit note: The inclusion of the term “extremely bouldery” in the map unit name indicates the common presence of boulders on the surface of the soil, which could impact use and management.

Figure 115.—Landscape of map unit 118 (Rock outcrop-Tsaya complex, 15 to 60 percent slopes, extremely bouldery).

Soil Properties and Qualities

Rock outcrop, Moenkopie and Cutler Group sandstones

This component is characterized by strongly sloping to steep rock outcrop. The lithology is sandstone. Slopes generally range from 30 to 75 percent. The vertical relief is from a few feet to several feet, and the continuity of cliffs is broken. Typically, the area is steep enough and there are enough cliffs to make travel by full-sized four-wheeled vehicles very difficult. There are usually no impediments to foot travel or to the movement of animals. The area is typically barren but may have vegetation growing in cracks and crevices or in thin layers of sediment covering the surface.

Tsaya soils

Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents (fig. 116)
Landform: Talus slopes, structural benches
Geology: Moenkopie Formation (Triassic) and Cutler Group (Permian) sandstones
Parent material: colluvium derived from sandstone and/or residuum weathered from sandstone

Slope: 15 to 60 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	10-30
Litter <5mm:	3-5
Rock Fragments:	60-75
Bare Soil:	5-10
Cyanobacteria Crust:	0-0
Lichen Crust:	0-0
Moss Crust:	0-0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 17 inches to bedrock, paralithic; 7 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.4 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 4 mmhos/cm (very slightly saline)

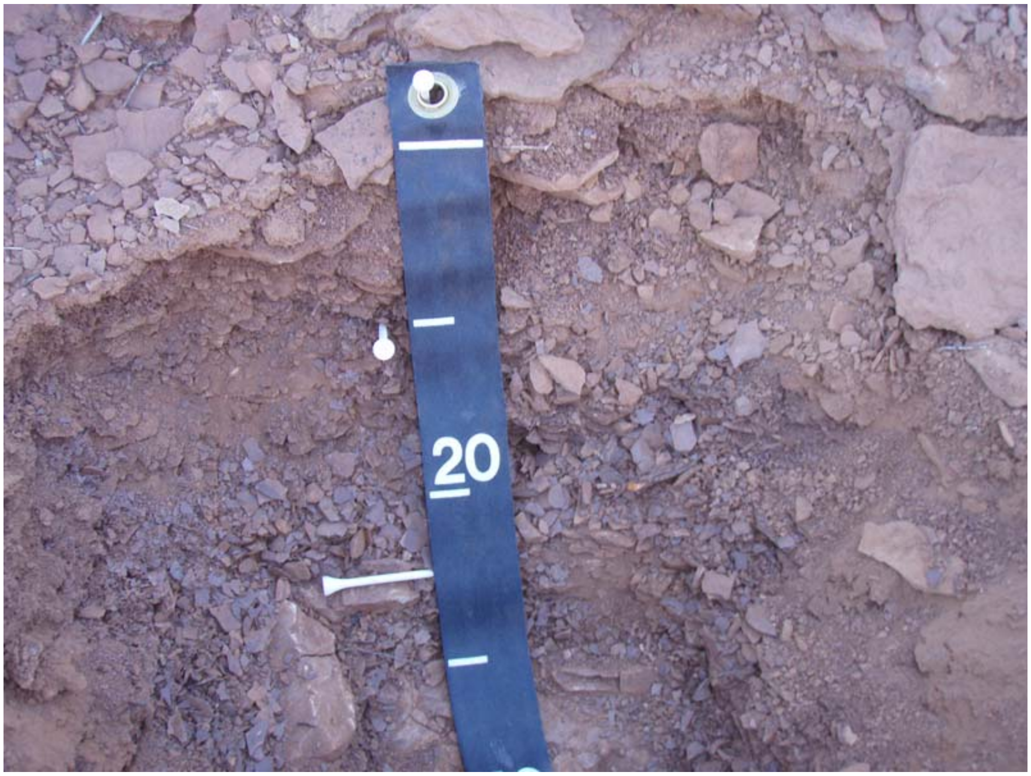


Figure 116.—Profile of Tsaya soil in map unit 118 (Rock outcrop-Tsaya complex, 15 to 60 percent slopes, extremely bouldery). Lithic contact is at 25 centimeters. Scale is in centimeters.

Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Desert Very Steep Stony Loam (Shadscale)
Ecological site number: R035XY146UT
Present vegetation (in most areas): shadscale saltbush, desert needlegrass, galleta, cheatgrass, desert princesplume, broom snakeweed, purple threeawn, crispleaf buckwheat
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
608,527 meters E, 4253,071 meters N, zone 12.

C—0 to 4 inches (0 to 10 cm); reddish yellow (5YR 6/6) very channery loam, dark reddish brown (5YR 3/4), moist; 21 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common fine irregular pores; 40 percent channers; strongly effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.
2Cr—4 to 6.5 inches (10 to 17 cm); soft Moenkopie Formation sandstone bedrock; very abrupt smooth boundary.
2R—6.5 to 16.5 inches (17 to 42 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

C horizon
Hue: 2.5YR, 5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist
Texture: loam, sandy loam, sandy clay loam
Clay content: 10 to 25 percent
Calcium carbonate equivalent: 1 to 10 percent
Rock fragments: 35 to 80 percent gravel or channers

119—Sazi-Rizno complex, 2 to 15 percent slopes

Map Unit Setting

General setting: The Maze, The Needles, Island in the Sky, and Horseshoe Canyon Districts, Canyonlands National Park (fig. 117)
Elevation: 4,510 to 6,260 feet (1,376 to 1,909 meters)
Mean annual precipitation: 9 to 13 inches (229 to 330 millimeters)
Mean annual air temperature: 50 to 56 degrees F (10.0 to 13.3 degrees C)
Mean annual soil temperature: 52 to 58 degrees F (11.1 to 14.4 degrees C)
Frost-free period: 160 to 180 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Sazi and similar soils: 50 percent
Rizno and similar soils: 30 percent
Minor Components:
- Arches soils–Semidesert Shallow Sandy Loam (Utah Juniper/Pinyon)
- Rock outcrop (Permian and Triassic sandstone)

Soil Properties and Qualities

Sazi soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocalcids (fig. 118)
Landform: Structural benches, mesas
Geology: Eolian Sand (Quaternary)
Parent material: eolian deposits
Slope: 2 to 15 percent, north to southeast aspects

Ground Cover:	(% Cover)
Plant Canopy:	20-25
Litter <5mm:	1-5
Rock Fragments:	50-75
Bare Soil:	0-5
Cyanobacteria Crust:	12-17
Lichen Crust:	0-1
Moss Crust:	0-1
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic; 20 to 37 inches to bedrock, paralithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 3.5 (low)
Shrink-swell potential: about 1.5 LEP (low)

Figure 117.—Landscape of map unit 119 (Sazi-Rizno complex, 2 to 15 percent slopes) on Island in the Sky.

Figure 118.—Profile of Sazi soil in map unit 119 (Sazi-Rizno complex, 2 to 15 percent slopes). Calcic horizon begins at 27 centimeters, lithic contact is at 89 centimeters (not visible in photo). Scale is in centimeters.

Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: high
Hydrologic group: B
Calcium carbonate maximum: about 35 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Semidesert Sandy Loam (Blackbrush)
Ecological site number: R035XY218UT
Present vegetation (in most areas): blackbrush, galleta, desert princesplume, scarlet globemallow, shadscale saltbush, Indian ricegrass, broom snakeweed
Land capability (non irrigated): 7e

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
587,049 meters E, 4232,558 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm); reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4), moist; 10 percent clay; moderate very thick platy structure; soft, very friable, slightly sticky and nonplastic; common very fine and fine roots throughout; many very fine and common fine irregular pores; common fine irregular carbonate masses in matrix; strongly effervescent, 8 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt wavy boundary.

Bk1—3.5 to 10.5 inches (9 to 27 cm); yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6), moist; 10 percent clay; moderate coarse subangular blocky and moderate very thick platy structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; many very fine and common fine irregular pores; many medium irregular carbonate masses in matrix; violently effervescent, 11 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

Bk2—10.5 to 27.5 inches (27 to 70 cm); light reddish brown (5YR 6/4) sandy loam, yellowish red (5YR 5/6), moist; 15 percent clay; moderate fine and medium subangular blocky structure; extremely hard, slightly rigid, slightly sticky and nonplastic; common very fine, fine, and medium roots in cracks; common very fine and fine irregular pores; violently effervescent, 36 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.

2Cr—27.5 to 29.5 inches (70 to 75 cm); soft Moenkopie Formation sandstone bedrock; abrupt wavy boundary.

2R—29.5 to 43.5 inches (75 to 110 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

A horizon
- Texture: fine sandy loam, fine sand
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: none

Bk1 horizon
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6, dry or moist
- Texture: fine sandy loam, fine sand
- Clay content: 1 to 10 percent
- Calcium carbonate equivalent: 5 to 15 percent
- Rock fragments: none
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Bk2 horizon
- Value: 5 or 6 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: sandy loam, fine sandy loam
- Clay content: 5 to 15 percent
- Calcium carbonate equivalent: 10 to 40 percent
- Rock fragments: 0 to 5 percent gravel
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Rizno soils

Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents (fig. 119)

Landform: Mesas, structural benches

Geology: Eolian Sand (Quaternary) and Sandstone Formations (Permian and Triassic)

Parent material: eolian deposits and/or residuum weathered from sandstone

Slope: 2 to 6 percent, east to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	20-25
Litter <5mm:	1-5
Rock Fragments:	50-75
Bare Soil:	0-5
Cyanobacteria Crust:	12-17
Lichen Crust:	0-1
Moss Crust:	0-1
Salt Crust:	0
Gypsum Crust:	0

Figure 119.—Profile of Rizno soil in map unit 119 (Sazi-Rizno complex, 2 to 15 percent slopes). Lithic contact is at 38 centimeters. Scale is in centimeters.

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: excessively drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.9 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Semidesert Shallow Sandy Loam (Blackbrush)
Ecological site number: R035XY233UT
Present vegetation (in most areas): blackbrush, desert princesplume, galleta, shadscale saltbush, Torrey's jointfir, Indian ricegrass
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
586,501 meters E, 4232,744 meters N, zone 12.

A—0 to 3 inches (0 to 8 cm); reddish brown (5YR 4/4) gravelly loamy coarse sand, dark reddish brown (5YR 3/4), moist; 2 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine and fine tubular pores; 20 percent gravel; strongly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt smooth boundary.

C—3 to 10 inches (8 to 25 cm); reddish brown (5YR 4/4) sandy loam, dark reddish brown (5YR 3/4), moist; 8 percent clay; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common very fine and fine tubular pores; 10 percent gravel; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; abrupt smooth boundary.

R—10 to 19.5 inches (25 to 50 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

A horizon
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 3 or 4, dry or moist
Texture: loamy coarse sand, fine sandy loam, loamy fine sand
Clay content: 2 to 15 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 5 to 25 percent gravel

C horizon
Value: 4 or 5 dry, 3 or 4 moist
Clay content: 8 to 15 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 10 to 40 percent gravel
Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

120—Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes

Map Unit Setting

General setting: White Rim region of The Maze District, Canyonlands National Park
Elevation: 3,980 to 5,220 feet (1,212 to 1,590 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Sheppard family and similar soils: 30 percent
Tsaya family and similar soils: 30 percent
Bluechief family and similar soils: 20 percent
Minor Components:
- Rock outcrop (White Rim Formation sandstone)
- Goblin taxadjunct soils–Desert Very Shallow Gypsum (Torrey Mormon tea)

Soil Properties and Qualities

Sheppard family soils
Taxonomic classification: Mixed, mesic Typic Torripsamments (fig. 120)
Landform: Structural benches (fig. 121)
Geology: Eolian Sand (Quaternary)
Parent material: eolian sands derived from sandstone
Slope: 2 to 15 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	2-5
Rock Fragments:	0-5
Bare Soil:	15-30
Cyanobacteria Crust:	15-35
Lichen Crust:	5-10
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic
Drainage class: somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr (rapid)
Available water capacity total inches: about 2.5 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: high
Hydrologic group: A
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Sandy Loam (Blackbrush)

Figure 120.—Profile of Sheppard family soil in map unit 120 (Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes). Scale is in centimeters.

Figure 121.—Landscape of Sheppard family soil in map unit 120 (Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes) in the Maze District.

Ecological site number: R035XY121UT
Present vegetation (in most areas): blackbrush, Indian ricegrass, shadscale saltbush, Torrey Mormon tea, desert trumpet buckwheat, galleta
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
584,797 meters E, 4232,009 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm); reddish brown (5YR 5/4) fine sand, reddish brown (5YR 4/4), moist; 1 percent clay; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine and common fine irregular pores; slightly effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; gradual wavy boundary.
Bk1—3.5 to 19.5 inches (9 to 50 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 7 percent clay; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots throughout; many very fine and common fine irregular pores; common medium irregular carbonate masses in matrix; 3 percent gravel; strongly effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.
Bk2—19.5 to 29.5 inches (50 to 75 cm); yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6), moist; 9 percent clay; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine and common fine irregular pores; common medium irregular carbonate masses in matrix; 10 percent gravel; violently effervescent, 20 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.
2R—29.5 to 39.5 inches (75 to 100 cm); hard White Rim Formation sandstone bedrock.

Range in Characteristics

This soil is mapped at the family level because the depth to hard bedrock ranges from 20 to 40 inches.

The Bk horizon lacks sufficient secondary carbonate accumulation to qualify as a calcic.

A horizon
Hue: 5YR, 7.5YR
Value: 4 or 5, dry or moist
Chroma: 4 or 6, dry or moist
Clay content: 1 to 5 percent
Calcium carbonate equivalent: 1 to 5 percent
Rock fragments: 0 to 1 percent gravel

Bk horizon
Hue: 5YR, 7.5YR, 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 4 or 6, dry or moist
Texture: loamy fine sand, fine sand
Clay content: 2 to 10 percent
Calcium carbonate equivalent: 5 to 10 percent
Rock fragments: 0 to 15 percent gravel

2C horizon (where present)
- Hue: 7.5YR, 10YR
- Value: 5 or 6 dry, 4 or 5 moist
- Chroma: 4 or 6, dry or moist
- Texture: loamy fine sand, fine sand, sand
- Clay content: 2 to 10 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 10 to 20 percent gravel

Tsaya family soils

Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents (fig. 122)
Landform: Structural benches (fig. 123)
Geology: Moenkopie Formation sandstone (Triassic)
Parent material: residuum weathered from sandstone
Slope: 2 to 15 percent, northeast to north aspects

Ground Cover:	(% Cover)
Plant Canopy:	35-45
Litter <5mm:	1-5
Rock Fragments:	15-20
Bare Soil:	20-30
Cyanobacteria Crust:	10-15
Lichen Crust:	1-5
Moss Crust:	1-5
Salt Crust:	0
Gypsum Crust:	0

Figure 122.—Profile of Tsaya family soil in map unit120 (Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes). Lithic contact is at 30 centimeters. Scale is in centimeters.

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.9 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 15 percent
Gypsum maximum: about 3 percent
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Shallow Sandy Loam (Blackbrush)
Ecological site number: R035XY133UT
Present vegetation (in most areas): blackbrush, Torrey Mormon tea, galleta, Brenda's yellow cryptantha, broom snakeweed, rubber rabbitbrush
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
584,866 meters E, 4231,950 meters N, zone 12.

Figure 123.—Landscape of Tsaya family component in map unit 120 (Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes) in the Maze District.

A—0 to 3 inches (0 to 8 cm); brown (7.5YR 5/4) fine sandy loam, strong brown (7.5YR 4/6), moist; 11 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine irregular pores; 5 percent gravel; violently effervescent, 10 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

C—3 to 10 inches (8 to 25 cm); strong brown (7.5YR 5/6) very gravelly fine sandy loam, strong brown (7.5YR 4/6), moist; 9 percent clay; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine irregular pores; common fine irregular gypsum crystals in matrix; 55 percent gravel; violently effervescent, 10 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

R—10 to 19.5 inches (25 to 50 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

This soil is mapped at the family level because it contains less than 18 percent clay in the particle size control section.

A horizon
- Hue: 5YR, 7.5YR
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: sandy loam, fine sandy loam
- Clay content: 8 to 15 percent
- Calcium carbonate equivalent: 5 to 15 percent
- Rock fragments: 5 to 30 percent gravel

C horizon
- Hue: 5YR, 7.5YR, 10YR
- Value: 4 or 5, dry or moist
- Chroma: 4 or 6, dry or moist
- Texture: sandy loam, fine sandy loam
- Clay content: 8 to 15 percent
- Calcium carbonate equivalent: 5 to 15 percent
- Gypsum: 0 to 3 percent
- Rock fragments: 40 to 65 percent gravel or channers

Bluechief family soils

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Typic Haplocalcids
Landform: Structural benches (fig. 124)
Geology: Eolian Sand (Quaternary) and Moenkopie Formation sandstone (Triassic)
Parent material: residuum weathered from sandstone
Slope: 2 to 8 percent, north to northwest aspects

Ground Cover:	(% Cover)
Plant Canopy:	40-50
Litter <5mm:	2-5
Rock Fragments:	0-5
Bare Soil:	15-30
Cyanobacteria Crust:	15-35
Lichen Crust:	5-10
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Figure 124.—Landscape of Bluechief family component of map unit 120 (Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes) in the Maze District.

Depth to restrictive feature(s): 20 to 40 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 1.8 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: high
Hydrologic group: C
Calcium carbonate maximum: about 15 percent
Gypsum maximum: about 4 percent
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Sandy Loam (Blackbrush)
Ecological site number: R035XY121UT
Present vegetation (in most areas): blackbrush, Indian ricegrass, shadscale saltbush, Torrey Mormon tea, desert trumpet buckwheat, galleta
Land capability (non irrigated): 7e

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
585,018 meters E, 4231,826 meters N, zone 12.

A—0 to 4 inches (0 to 10 cm); reddish brown (5YR 5/4) gravelly sandy loam, reddish brown (5YR 4/4), moist; 15 percent clay; moderate fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common very fine tubular pores; 30 percent gravel; violently effervescent, 7 percent calcium carbonate equivalent and 3 percent gypsum; moderately alkaline, pH 8.0; abrupt wavy boundary.

Bk—4 to 22 inches (10 to 56 cm); reddish brown (5YR 5/4) channery sandy loam, reddish brown (5YR 4/4), moist; 13 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine tubular pores; few fine irregular gypsum crystals in matrix and common medium irregular carbonate masses in matrix; 30 percent channers; violently effervescent, 12 percent calcium carbonate equivalent and 3 percent gypsum; moderately alkaline, pH 8.4; abrupt wavy boundary.

R—22 to 32 inches (56 to 81 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

This soil is mapped at the family level because it contains greater than 20 percent coarse fragments in the Bk and C horizons.

A horizon
- Value: 4 or 5, dry or moist
- Texture: sandy loam, loamy fine sand
- Clay content: 8 to 15 percent
- Calcium carbonate equivalent: 5 to 10 percent
- Rock fragments: 0 to 30 percent gravel

Bk horizon
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 3 or 4, dry or moist
- Clay content: 10 to 15 percent
- Calcium carbonate equivalent: 10 to 15 percent
- Gypsum: 0 to 4 percent
- Rock fragments: 15 to 30 percent gravel or channers

C horizon (where present)
- Hue: 5YR, 10YR
- Value: 5 to 7 dry, 4 or 5 moist
- Clay content: 10 to 15 percent
- Calcium carbonate equivalent: 10 to 15 percent
- Rock fragments: 25 to 30 percent gravel or channers

121—Torriorthents-Rock outcrop-Badland complex, 4 to 70 percent slopes, extremely bouldery

Map Unit Setting

General setting: The Maze and The Island in the Sky Districts, Canyonlands National Park
Elevation: 4,040 to 6,400 feet (1,231 to 1,952 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Torriorthents and similar soils: 45 percent
Rock outcrop, Wingate Formation sandstone: 30 percent
Badland, Chinle Formation: 25 percent
Minor Components:
- Tsaya family soils–Desert Shallow Sandy Loam (Shadscale)

Map unit note: The inclusion of the term “extremely bouldery” in the map unit name indicates the common presence of boulders on the surface of the soil, which could impact use and management.

Soil Properties and Qualities

Torriorthents soils
Taxonomic classification: Torriorthents (fig. 125)
Landform: Scarp slopes, hills (fig. 126)
Geology: Wingate and Chinle Formations (Triassic)
Parent material: colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale
Slope: 4 to 70 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	10-20
Litter <5mm:	2-5
Rock Fragments:	60-70
Bare Soil:	15-25
Cyanobacteria Crust:	0
Lichen Crust:	0
Moss Crust:	0
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to greater than 60 inches
Drainage class: well drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 1.6 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: B
Calcium carbonate maximum: about 15 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 0 SAR (nonsodic)
Ecological site name: Desert Very Steep Stony Loam (Shadscale)
Ecological site number: R035XY146UT
Present vegetation (in most areas): shadscale saltbush, desert trumpet buckwheat, desert princesplume, Torrey Mormon tea, aster
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
593,015 meters E, 4258,814 meters N, zone 12.

Figure 125.—Profile of Torriorthents soil in map unit 121 (Torriorthents-Rock outcrop-Badland complex, 4 to 70 percent slopes, extremely bouldery). Scale is in centimeters.

Figure 126.—Landscape of map unit 121 (Torriorthents-Rock outcrop-Badland complex, 4 to 70 percent slopes, extremely bouldery).

A—0 to 4 inches (0 to 10 cm); reddish brown (5YR 4/4) very gravelly sandy loam, dark reddish brown (5YR 3/4), moist; 15 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots throughout; common fine irregular pores; 40 percent gravel and 7 percent cobbles; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; clear wavy boundary.

C—4 to 27 inches (10 to 68 cm); reddish brown (5YR 4/4) very cobbly sandy loam, dark reddish brown (5YR 3/4), moist; 14 percent clay; massive; hard, firm, slightly sticky and nonplastic; common very fine and fine roots throughout; common fine irregular pores; 20 percent gravel, 25 percent cobbles, and 10 percent stones; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.0; abrupt wavy boundary.

R—27 to 36.5 inches (68 to 93 cm); hard Chinle Formation sandstone bedrock.

Range in Characteristics

This soil was mapped at the Subgroup level because of variation in coarse fragments and in the depth and hardness of bedrock. Observations include shallow and lithic, as well as deeper soils.

A horizon
- Hue: 5YR, 7.5YR
- Value: 3 or 4, dry or moist
- Texture: sandy loam, silt loam, loam
- Clay content: 10 to 18 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 5 to 50 percent channers, gravel and cobbles
- Reaction: slightly alkaline or moderately alkaline (pH 7.4 to 8.4)

C horizon
- Hue: 2.5YR, 5YR
- Value: 3 or 4, dry or moist
- Chroma: 3 or 4, dry or moist
- Texture: sandy loam, loam, clay loam, coarse sandy loam
- Clay content: 10 to 35 percent
- Calcium carbonate equivalent: 1 to 15 percent
- Rock fragments: 5 to 80 percent

Rock outcrop, Wingate Formation sandstone
This component is characterized by very tall, nearly continuous, nearly vertical cliffs and escarpments. The lithology is sandstone. Slopes generally range from 50 to greater than 100 percent. The vertical relief ranges from several tens to several hundreds of feet. Travel by any type of wheeled vehicle is virtually impossible. Travel by foot is extremely difficult or nearly impossible and is usually hazardous. This component is a natural barrier to livestock and most terrestrial animals.

Badland, Chinle Formation
This component is composed of soft, partially weathered interbedded shale and siltstone (fig. 127). Slopes generally range from 35 to nearly 100 percent. Typically, the area is steep enough and the material is loose enough to make travel by full-sized four-wheeled vehicles very difficult. The areas with steeper slopes result in impediments to foot travel and animals. The area is typically barren.

Figure 127.—Badland component in map unit 121 (Torriorthents-Rock outcrop-Badland complex, 4 to 70 percent slopes, extremely bouldery). Badland component is visible as light-colored, non-vegetated hills.

122—Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery

Map Unit Setting

General setting: Escarpments above the Colorado and Green Rivers in Island in the Sky, The Needles, and The Maze Districts, Canyonlands National Park (fig. 128)
Elevation: 3,740 to 5,570 feet (1,140 to 1,699 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Torriorthents and similar soils: 50 percent
Rock outcrop, Pennsylvanian: 40 percent
Minor Components:
- Ustic Torriorthents–Semidesert Very Steep Stony Loam (Utah Juniper/Pinyon)

Map unit note: The inclusion of the term “extremely bouldery” in the map unit name indicates the common presence of boulders on the surface of the soil, which could impact use and management.

Figure 128.—Landscape of map unit 122 (Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery), viewed from the Colorado River Overlook in the Needles District.

Soil Properties and Qualities

Torriorthents soils

Taxonomic classification: Torriorthents (fig. 129)
Landform: Scarp slopes
Geology: Halgaito Shale, Honaker Trail, and Paradox Formations (Pennsylvanian)
Parent material: colluvium derived from arenaceous limestone
Slope: 35 to 70 percent, north to west aspects

Ground Cover:	(% Cover)
Plant Canopy:	10-20
Litter <5mm:	0-5
Rock Fragments:	50-70
Bare Soil:	10-20
Cyanobacteria Crust:	0-5
Lichen Crust:	0-5
Moss Crust:	0-5
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 4 to 40 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 0.6 to 2.0 in/hr (moderate)
Available water capacity total inches: about 4.5 (low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none

Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: B
Calcium carbonate maximum: about 25 percent
Gypsum maximum: none
Salinity maximum: about 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: about 5 SAR (slightly sodic)
Ecological site name: Desert Very Steep Stony Loam (Shadscale)
Ecological site number: R035XY146UT

Figure 129.—Profile of Torriorthents soil in map unit 122 (Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery). Lithic contact is at 40 centimeters. Scale is in centimeters.

Present vegetation (in most areas): needle and thread, galleta, mat saltbush, roundleaf buffaloberry, green Mormon tea, Utah juniper, fourwing saltbush
Land capability (non irrigated): 7s

Typical Profile

Location
Geographic Coordinate System (Universal Transverse Mercator):
596,017 meters E, 4223,617 meters N, zone 12.

A—0 to 4.5 inches (0 to 11 cm); reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6), moist; 14 percent clay; weak very fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots throughout; common very fine irregular pores; strongly effervescent, 15 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear wavy boundary.
2C1—4.5 to 15.5 inches (11 to 40 cm); strong brown (7.5YR 5/6) fine sandy loam, brown (7.5YR 4/4), moist; 17 percent clay; massive; hard, firm, slightly sticky and slightly plastic; common fine roots throughout; common fine irregular pores; 4 percent gravel and 10 percent channers; violently effervescent, 20 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; gradual wavy boundary.
2C2—15.5 to 33 inches (40 to 84 cm); reddish yellow (7.5YR 7/6) gravelly fine sandy loam, strong brown (7.5YR 5/6), moist; 19 percent clay; massive; hard, firm, slightly sticky and slightly plastic; common fine roots throughout; common very fine irregular pores; 20 percent gravel and 2 percent stones; violently effervescent, 20 percent calcium carbonate equivalent; strongly alkaline, pH 8.6; clear wavy boundary.
2R—33 to 43 inches (84 to 109 cm); hard Pennsylvanian limestone bedrock.

Range in Characteristics

This soil was mapped at the Subgroup level because of variation in coarse fragments, textures, and depth to bedrock.

A horizon
Hue: 5YR, 7.5YR
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 4 or 6, dry or moist
Texture: fine sandy loam, loamy fine sand, fine sand, coarse sand
Clay content: 5 to 15 percent
Calcium carbonate equivalent: 5 to 15 percent
Rock fragments: 0 to 20 percent gravel

C horizon
Hue: 2.5YR, 5YR, 7.5YR
Value: 4 to 7 dry, 3 to 5 moist
Chroma: 4 or 6, dry or moist
Texture: fine sandy loam, sandy loam, sandy clay loam, loamy sand, loamy coarse sand
Clay content: 10 to 35 percent
Calcium carbonate equivalent: 10 to 25 percent
Rock fragments: 0 to 60 percent gravel, channers, cobbles, and stones
Reaction: moderately alkaline or strongly alkaline (pH 7.9 to 9.0)

Bw horizons are present in some horizons, but are too thin to qualify as cambic horizons.

Rock outcrop, Pennsylvanian
This component is characterized by very tall, nearly continuous, nearly vertical cliffs and escarpments. The lithology is sandy limestone. Slopes generally range from 35

to 100 percent. The vertical relief ranges from several tens to several hundreds of feet. Travel by any type of wheeled vehicle is virtually impossible. Travel by foot is extremely difficult or nearly impossible and is usually hazardous. This component is a natural barrier to livestock and most terrestrial animals.

123—Tsaya family-Moenkopie complex, 2 to 15 percent slopes

Map Unit Setting

General setting: White Rim region of Island in the Sky, The Maze, and The Needles Districts, Canyonlands National Park (fig. 130)
Elevation: 3,910 to 5,370 feet (1,192 to 1,637 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)
Mean annual soil temperature: 55 to 61 degrees F (12.8 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Tsaya family and similar soils: 50 percent
Moenkopie and similar soils: 40 percent
Minor Components:
- Rock outcrop (Moenkopie Formation (Triassic) and Cutler Group (Permian) sandstones)

Figure 130.—Landscape of map unit 123 (Tsaya family-Moenkopie complex, 2 to 15 percent slopes) on the White Rim.

Figure 131.—Tsaya family soils in map unit 123 (Tsaya family-Moenkopie complex, 2 to 15 percent slopes). Lithic contact is at 25 centimeters. Scale is in centimeters.

- Aneth soils–Desert Sand (Sand Sagebrush)
- Tsaya soils–Desert Shallow Sandy Loam (Blackbrush)

Map unit note: Tsaya and Moenkopie soils in near proximity to White Rim sandstone rock outcrop often have a thin skiff of light colored sand on the surface, which does not affect the use, management, or classification of the soils.

Soil Properties and Qualities

Tsaya family soils

Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents (fig. 131)
Landform: Structural benches
Geology: Moenkopie Formation (Triassic) and Cutler Group (Permian) sandstones
Parent material: residuum weathered from sandstone and/or slope alluvium derived from sandstone

Slope: 2 to 15 percent, north to west aspects

Ground Cover:	(% Cover)
Plant Canopy:	45-50
Litter <5mm:	1-5
Rock Fragments:	30-35
Bare Soil:	10-20
Cyanobacteria Crust:	0-3
Lichen Crust:	0-3
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 10 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.9 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 5 percent
Gypsum maximum: none
Salinity maximum: about 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Desert Shallow Sandy Loam (Shadscale)
Ecological site number: R035XY130UT
Present vegetation (in most areas): galleta, shadscale saltbush, Torrey Mormon tea
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
587,832 meters E, 4249,203 meters N, zone 12.

A—0 to 3.5 inches (0 to 9 cm); reddish brown (5YR 5/4) sandy loam, reddish brown (5YR 4/4), moist; 11 percent clay; weak fine subangular blocky and moderate medium platy structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common fine tubular pores; 5 percent fine gravel and 2 percent channers; strongly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.

Bw—3.5 to 9 inches (9 to 23 cm); reddish brown (5YR 4/4) coarse sandy loam, dark reddish brown (5YR 3/4), moist; 14 percent clay; moderate fine and weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots throughout; common fine tubular pores; 10 percent fine gravel; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

C—9 to 16 inches (23 to 41 cm); reddish brown (5YR 4/4) extremely channery sandy loam, dark reddish brown (5YR 3/4), moist; 15 percent clay; massive; very hard, extremely firm, slightly sticky and nonplastic; common fine roots in cracks; common fine tubular pores; 70 percent channers; violently effervescent, 5 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; abrupt wavy boundary.

R—16 to 26 inches (41 to 66 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

This soil is mapped at the family level because it contains less than 18 percent clay in the particle size control section.

A horizon
- Value: 4 or 5 dry, 3 or 4 moist
- Chroma: 4 or 6 dry, 3 to 6 moist
- Texture: sandy loam, loamy coarse sand
- Clay content: 10 to 20 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Electrical conductivity: 0 to 4 mmhos/cm
- Rock fragments: 5 to 70 percent gravel or channers

Bw horizon
- Hue: 2.5YR, 5YR
- Value: 3 or 4, dry or moist
- Chroma: 3 to 6, dry or moist
- Texture: coarse sandy loam, sandy loam
- Clay content: 10 to 20 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Electrical conductivity: 0 to 4 mmhos/cm
- Rock fragments: 10 to 80 percent gravel or channers

C horizon
- Hue: 2.5YR, 5YR
- Value: 3 or 4, dry or moist
- Chroma: 3 to 6, dry or moist
- Texture: coarse sandy loam, sandy loam
- Clay content: 10 to 20 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Electrical conductivity: 0 to 4 mmhos/cm
- Rock fragments: 35 to 80 percent gravel or channers

Bw horizons are present in some pedons, but are too thin to qualify as cambic horizons.

Moenkopie soils

Taxonomic classification: Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents (fig. 132)
Landform: Structural benches
Geology: Moenkopie Formation (Triassic) and Cutler Group (Permian) sandstones
Parent material: residuum weathered from sandstone and/or slope alluvium derived from sandstone
Slope: 2 to 15 percent, north to northwest aspects

Ground Cover:	(% Cover) (fig.133)
Plant Canopy:	45-50
Litter <5mm:	1-5
Rock fragments:	35-40
Bare Soil:	5-10
Cyanobacteria Crust:	0-3
Lichen Crust:	0-3
Moss Crust:	0-3
Salt Crust:	0
Gypsum Crust:	0

Depth to restrictive feature(s): 8 to 20 inches to bedrock, lithic
Drainage class: well drained

Figure 132.—Soil profile of Moenkopie soil in map unit 123 (Tsaya family-Moenkopie complex, 2 to 15 percent slopes). Scale is in centimeters.

Figure 133.—Typical surface of soils in map unit 123 (Tsaya family-Moenkopie complex, 2 to 15 percent slopes).

Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.7 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D
Calcium carbonate maximum: about 10 percent
Gypsum maximum: none
Salinity maximum: about 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Desert Shallow Sandy Loam (Shadscale)
Ecological site number: R035XY130UT
Present vegetation (in most areas): shadscale saltbush, galleta, cheatgrass, Torrey Mormon tea, broom snakeweed, Indian ricegrass
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
607,329 meters E, 4251,894 meters N, zone 12.

A—0 to 2.5 inches (0 to 6 cm); yellowish red (5YR 5/6) loamy sand, yellowish red (5YR 4/6), moist; 9 percent clay; moderate coarse granular and moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots throughout; common very fine irregular pores; 10 percent channers; strongly effervescent, 7 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.
2C—2.5 to 8 inches (6 to 20 cm) channery sandy loam; 13 percent clay; massive; moderately hard, firm, slightly sticky and nonplastic; common fine roots throughout; common very fine irregular pores; 20 percent channers; slightly effervescent, 3 percent calcium carbonate equivalent; moderately alkaline, pH 8.2; clear wavy boundary.
2R—8 to 17.5 inches (20 to 45 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

A horizon
Hue: 2.5YR, 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist
Texture: loamy sand, sandy loam
Clay content: 9 to 18 percent
Calcium carbonate equivalent: 1 to 10 percent
Electrical conductivity: 0 to 4 mmhos/cm
Rock fragments: 10 to 15 percent gravel

C horizon
Hue: 2.5YR, 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 1 to 10 percent
Electrical conductivity: 0 to 4 mmhos/cm

Rock fragments: 10 to 60 percent channers (particle size control section averages less than 35 percent)

Bw horizons are present in some pedons, but are too thin to qualify as cambic horizons.

124—Tsaya family-Rock outcrop complex, 35 to 80 percent slopes

Map Unit Setting

General setting: Upheaval Dome, Island in the Sky District, Canyonlands National Park (figs. 134, 135)
Elevation: 4,510 to 5,330 feet (1,374 to 1,626 meters)
Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)
Mean annual air temperature: 52 to 59 degrees F (11.1 to 15.0 degrees C)
Mean annual soil temperature: 54 to 61 degrees F (12.2 to 16.1 degrees C)
Frost-free period: 175 to 195 days
Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Tsaya family and similar soils: 65 percent
Rock outcrop, Triassic and Permian sandstones: 15 percent

Figure 134.—Landscape of map unit 124 (Tsaya family-Rock outcrop complex, 35 to 80 percent slopes) from within Upheaval Dome.

Figure 135.—View into Upheaval Dome from the rim.

Soil Properties and Qualities

Tsaya family soils

Taxonomic classification: Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents (fig. 136)
Landform: Hills
Geology: Moenkopie and Chinle Formations (Triassic)
Parent material: residuum weathered from sandstone
Slope: 35 to 80 percent, north aspect

Ground Cover:	(% Cover)
Plant Canopy:	5-20
Litter <5mm:	0-10
Rock Fragments:	40-60
Bare Soil:	15-40
Cyanobacteria Crust:	0-10
Lichen Crust:	0
Moss Crust:	0
Salt Crust:	0-10
Gypsum Crust:	0-10

Depth to restrictive feature(s): 4 to 20 inches to bedrock, lithic
Drainage class: well drained
Slowest permeability: 2.0 to 6.0 in/hr (moderately rapid)
Available water capacity total inches: about 0.6 (very low)
Shrink-swell potential: about 1.5 LEP (low)
Flooding hazard: none
Ponding hazard: none
Seasonal water table minimum depth: greater than 60 inches
Runoff class: very high
Hydrologic group: D

Calcium carbonate maximum: about 5 percent
Gypsum maximum: about 5 percent
Salinity maximum: about 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: about 2 SAR (slightly sodic)
Ecological site name: Desert Very Steep Stony Loam (Shadscale)
Ecological site number: R035XY146UT
Present vegetation (in most areas): Utah juniper, big galleta, Columbia needlegrass, Indian ricegrass, buckwheat, skunkbush sumac, desert princesplume, Jones' pepperweed, fourwing saltbush
Land capability (non irrigated): 7s

Typical Profile

Location

Geographic Coordinate System (Universal Transverse Mercator):
593,218 meters E, 4254,952 meters N, zone 12.

C1—0 to 2.5 inches (0 to 6 cm); reddish brown (2.5YR 4/4) very gravelly sandy loam, dark reddish brown (2.5YR 3/4), moist; 16 percent clay; weak fine granular structure; moderately hard, firm, slightly sticky and slightly plastic; few fine roots throughout; 50 percent gravel; very slightly effervescent, 2 percent calcium carbonate equivalent; moderately alkaline, pH 8.4; clear smooth boundary.

C2—2.5 to 11.5 inches (6 to 29 cm); dark reddish brown (2.5YR 3/4) extremely gravelly sandy loam, dark reddish brown (2.5YR 2.5/4), moist; 18 percent clay; weak fine granular structure; moderately hard, firm, slightly sticky and slightly plastic; few fine roots throughout; 60 percent gravel; very slightly effervescent, 2

Figure 136.—Profile of Tsaya family soil in map unit 124 (Tsaya family-Rock outcrop complex, 35 to 80 percent slopes). Lithic contact is at 14 centimeters. Scale is in centimeters.

percent calcium carbonate equivalent; strongly alkaline, pH 8.6; abrupt smooth boundary.

R—11.5 to 21.5 inches (29 to 54 cm); hard Moenkopie Formation sandstone bedrock.

Range in Characteristics

Tsaya soils are mapped at the family level in this map unit because the clay content throughout the profile varies to a greater degree than allowed in the official series.

C horizon
- Value: 3 to 5 dry, 2.5 to 4 moist
- Texture: loam, sandy loam
- Clay content: 10 to 20 percent
- Calcium carbonate equivalent: 1 to 5 percent
- Rock fragments: 35 to 70 percent gravel or channers
- Reaction: moderately alkaline or strongly alkaline (7.9 to 9.0)

Rock outcrop, Triassic and Permian sandstones

This component is characterized by many cliffs and escarpments with very steep colluvial and talus slopes. The lithology is sandstone. Slopes generally range from 30 percent to vertical. The vertical relief of the outcrops ranges from a few feet to several tens of feet and is very broken. Typically, the steepness and vertical relief of rock outcrops make travel by full-sized four-wheeled vehicles virtually impossible. Travel by foot is difficult and strenuous. This component is usually a natural barrier to livestock and to many terrestrial animals.

125—Water

Map Unit Setting

General setting: Colorado and Green Rivers in the River District of Canyonlands National Park

Elevation: 3,740 to 4,220 feet (1,140 to 1,285 meters)

Mean annual precipitation: 5 to 9 inches (127 to 229 millimeters)

Mean annual air temperature: 53 to 59 degrees F (11.7 to 15.0 degrees C)

Major Land Resource Area: 35–Colorado Plateau

Map Unit Composition

Water: 95 percent

Minor Components:

- Sandbars that are transient in nature and primarily non-vegetated

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited.* The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor.*

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one

limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

There are no soils in Canyonlands National Park that meet the criteria for Prime Farmland as defined by the U.S Department of Agriculture. Some of the reasons for disqualification are excessive coarse fragments, high susceptibility to wind erosion, excessive slope, low available water capacity, excessive wetness, and excessive salts. Each soil identified in Canyonlands National Park fails to meet the requirements for Prime Farmland for one or more of the above reasons.

Rangeland and Woodland Understory Vegetation

Areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation are closely related to the soil. Effective management is based on the relationship between the soils, vegetation, and water. Rangeland is typically defined as a type of land that supports vegetation suitable for grazing (grasses, forbs, and shrubs) and is managed by ecological, rather than agronomic methods. However, for this survey, the term rangeland is used loosely to describe all land that produces any type of vegetation and is managed by ecological rather than agronomic methods. Therefore all soil components that support vegetation are assigned an ecological site which details the relationship between the soils, vegetation, and water.

Table 6 includes map unit and details for each soil component, including the ecological site, existing vegetation at the time of the survey, estimated total annual production of the existing vegetation in favorable, normal, and unfavorable years, and typical percentage of dominant species measured by annual production.

Landscapes are divided into ecological sites for the purposes of inventory, evaluation, and management. An *ecological site* is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. An ecological site is the product of all environmental factors responsible for its development. It has characteristic soils that developed over time including characteristic hydrology. Hydrology is influenced

by soil and plant community development and typically describes infiltration and permeability rates. The vegetation, soils, and hydrology are interrelated and influenced each other. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. The ecological site description contains details about the characteristic soils, plant community, different steady states that are expected, possible transitions, and site interpretations. For a full ecological site description that includes a state and transition model refer to the Ecological Site Information System (ESIS) at http://esis.sc.egov.usda.gov. You may also refer to the Ecological Site Description Report for Canyonlands National Park.

Total dry-weight production is the amount of vegetation that can be expected to grow annually in a well managed area that supports the existing plant community at the time of the survey. It includes the current year's vegetative growth of leaves, twigs, flowers, and fruits, whether or not it is palatable to grazing animals. It does not include the increase in stem diameter of trees and shrubs. Estimated total annual production values, in pounds per acre of air-dry vegetation, is given for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Characteristic vegetation—this column reports the dominant grasses, forbs, shrubs and trees by annual production of the existing plant community at the time of the survey.

Composition—this column gives the typical percentage of the total annual production for the dominant species of the existing vegetation. The amount that can be used as forage depends on the grazing animals and grazing season.

Information about rangeland management including range similarity index and rangeland trend is available in chapter 4 of the "National Range and Pasture Handbook" available on the Internet at http://www.glti.nrcs.usda.gov/technical/publications/nrph.html.

Tables 7 and 8 show the common plants in the survey area. In table 7 they are sorted by plant symbol, and in table 8 they are listed in order of local common name.

The native rangeland and forest understory ecological sites are described in the paragraphs that follow and are illustrated in figures 137 through 155. The short descriptions depict conditions for the associated ecological site as found within Canyonlands National Park, which is a subset within the entire range of the ecological site.

Figure 137.—R035XY003UT — Alkali Bottom (Greasewood)

This ecological site typically occurs on stream terraces. Runoff is very low to low. Slopes typically range from 0 to 8 percent. Soils on this site are very deep and well to excessively drained. Available water capacity is low to moderate. Typical native plant species include greasewood *(Sarcobatus vermiculatus)*, fourwing saltbush *(Atriplex canescens)*, rubber rabbitbrush *(Ericameria nauseosa)*, alkali sacaton *(Sporobolus airoides)*, spike dropseed *(Sporobolus contractus)*, sand dropseed *(Sporobolus cruptandrus)*, and Indian ricegrass *(Achnoatherum hymenoides).*

Figure 138.—R035XY011UT — Loamy Bottom (Basin Big Sagebush)

This ecological site occurs on intermediate flood-plain steps. Runoff potential is very low. The slope of this ecological site is typically 1 to 6 percent. Available water capacity is low. Soils of this site are very deep and excessively drained. Typical native plant species of this site include basin big sagebrush *(Artemesia tridentate* ssp. tridentate), rubber rabbitbrush *(Ericameria nauseosa)*, Fremont cottonwood *(Populus fremontii* S.Wats.), Fremont's mahonia *(Mahonia fremontii)*, greasewood *(Sarcobatus vermiculatus)*, and Indian ricegrass *(Achnatherum hymenoides).*

Figure 139.—R035XY013UT — Semiwet Fresh Streambank (Fremont Cottonwood)

This site typically occurs on dunes on low flood plain steps. Runoff is very low because of the low slope (0 to 6 percent) and the rapid permeability of the soil. Soils are very deep and somewhat poorly drained to excessively drained. Available water capacity is low to moderate. Typical native plant species of this site are Fremont cottonwood *(Populus fremontii)*, basin big sagebrush *(Artemisis tridentate ssp. Tridentat)*, saltgrass *(Distichlis spicata)*, lambsquarters *(Chenopodium album)*, slender wheatgrass *(Elymus trachycaulus)*, Canada wildrye *(Elymus canadensis)*, field horsetail *(Equisetum arvense)*, Baltic rush *(Juncus balticus)*, willow *(Salix L.)*, and ragwort *(Senecio L.).*

Figure 140.—R035XY019UT —Shallow Sand Rock Pocket (Utah Juniper-Pinyon)

Common landforms on which this ecological site typically occurs include mesas, structural benches, and buttes. Runoff is very high. Slopes typically range from 2 to 15 percent, but this site has been recorded on slopes as steep as 60 percent. Soils are very shallow to shallow and somewhat excessively to excessively drained. Available water capacity is very low. Typical native plant species include Utah Juniper *(Juniperus osteosperma)*, twoneedle pinyon *(Pinus edulis)*, Utah serviceberry *(Amelanchierutahensis Koehne)*, littleleaf mountain mahogany *(Cercocarpus intricatus)*, other mountain mahogany species *(Cercocarpus L.)*, blackbrush *(Coleogyne wrightii)*, ephedras *(Ephedra L.)*, rubber rabbitbrush *(Ericameria nauseosa)*, singleleaf ash *(Fraxinus anomala)*, Stansbury cliffrose *(Purshia stansburiana)*, Havard oak *(Quercus havardii)*, New Mexico feathergrass *(Hesperostipa neomexicana)*, Jones' pepperweed *(Lepidium montanum var. jonesii)*, sand dropseed *(sporobolus cryptandrus)*, and Indian ricegrass *(Achnatherum hymenoides).*

Figure 141.—R035XY121UT —Desert Sandy Loam (Blackbrush)

This ecological site occurs on structural benches. Slopes typically range from 2 to 18 percent. The available water capacity for this site is very low to low. Soils are moderately deep and well to somewhat excessively drained. Typical native plant species include blackbrush *(Coleogyne ramosissima)*, shadscale saltbush *(Atriplex confertifolia)*, rubber rabbitbrush *(Ericameria nauseosa)*, and James' galleta *(Pleuraphis jamesii).*

Figure 142.—R035XY130UT —Desert Shallow Sandy Loam (Shadscale)

This ecological site occurs on structural benches. Runoff is very high (because of the shallow depth). Typically slopes range from 2 to 15 percent. The available water capacity is very low. Soils are shallow and well drained. Typical native plant species include shadscale saltbush *(Atriplex confertifolia)*, blackbrush *(Coleogyne ramosissima)*, Torrey's tea *(Ephedra Torreyana)*, littleleaf horsebrush *(Tetradymia glabrata)*, Indian ricegrass, and James' galleta *(Plueraphis jamesii).*

Figure 143.—R035XY133UT —Desert Shallow Sandy Loam (Blackbrush)

This ecological site is located on structural benches and mesas. Runoff is very high. Slopes typically range from 2 to 15 percent. The available water capacity is very low. The soils on this site are moderately deep to deep and well to excessively drained. Typical native plant species include blackbrush *(Coleogyne ramossisima)*, shadscale saltbush *(Atriplex confertifolia)*, and broom snakeweed *(Gutienezias arothuae)* and James' galleta *(Pleuraphis jamesii).*

Figure 144.—R035XY136UT —Desert Stony Loam (Shadscale-Budsage)

This site commonly occurs on alluvial flats. Runoff potential is very low. Slopes typically range from 1 to 6 percent. The available water capacity is moderate. Soils are very deep and excessively drained. Typical native plant species are shadscale saltbush *(Atriplex confertifolia)*, bud sagebrush *(Picrothamnus desertorum)*, sand sagebrush *(Artemisia filifolia)*, James' galleta *(Pleuraphis jamesii)*, and Indian ricegrass *(Achnatherum hymenoides).*

Figure 145.—R035XY142UT —Desert Very Shallow Gypsum (Torrey's Jointfir)

This ecological site commonly occurs on hills. Runoff is very high. Slopes typically range from 6 to 45 percent. Available water capacity is very low. Soils are very shallow to shallow and somewhat excessively drained. Typical native plant species of this site include Torrey's jointfir *(Ephedra torreyena)*, shadscale saltbush *(Atriplex confertifolia)*, blackbrush *(Coleogyne ramosissima)*, rubber rabbitbrush *(Ericameria nauseosa)*, and James' galleta *(Pleuraphis jamesii).*

Figure 146.—R035XY146UT —Desert Very Steep Stony Loam (Shadscale)

This ecological site occurs on talus slopes, structural benches, scarp slopes, and hills. Runoff is very high. Typically slopes range from 4 to 80 percent. Available water capacity is very low. Soils are very shallow to very deep and well drained. Typical native plant species include shadscale saltbush *(Atriplex confertifolia)*, Torrey's jointfir *(Ephedra torreyana)*, desert princesplume *(Stanleya pinnata)*, sumac *(Rhus L.)*, Indian ricegrass *(Achnatherum hymenoides)*, desert needlegrass *(Achnatherum speciosum)*, and James' galleta *(Pleuraphis jamesii).*

Figure 147.—R035XY210UT —Semidesert Sand (Blackbrush)

This ecological site occurs on dunes on structural benches, upper valley sides, and mesas. Runoff is very low. Slopes on this ecological site are typically 2 to 15 percent. Soils are very deep and excessively drained. The available water capacity is low. Typical native plant species of this site include blackbrush *(Coleogyen ramosissima)*, Cutler's jointfir *(Ephedra cutleri)*, sand sagebrush *(Artemisia filifolia)*, rubber rabbitbrush *(Ericameria nauseosa)*, Indian ricegrass *(Achnatherum hymenoides)*, and needle and thread*(Hesperostipa comata).*

Figure 148.—R035XY212UT —Semidesert Sand (Fourwing Saltbush)

This ecological site occurs on dunes and sand sheets on terraces and mesas, in grabens, and on valley sides. Vegetated dunes are very common. Depending on plant community and the presence or absence of disturbance, active dunes can become more prevalent. Runoff potential is very low to low. Slopes typically range from 2 to 30 percent. Soils are moderately deep to very deep, and well to excessively drained. Available water capacity is very low to moderate. Typical native plants include fourwing saltbush *(Atriplex canescens)*, sand sagebrush *(Artemesia filifolia)*, blackbrush *(Coleogyne ramosissima)*, Cutler's jointfir *(Ephedra torreyana)*, winterfat *(Krascherinnikivia lanata)*, scarlet globemallow *(Sphaeralcea coccina)*, Indian ricegrass *(Achnatherum hymenoides)*, and James' galleta *(Plueraphis jamesii).*

Figure 149.—R035XY215UT —Semidesert Sandy Loam (Fourwing Saltbush)

Valley floors, sand sheets on mesas, sand sheets on structural benches, and mesas are land forms on which this ecological site commonly occurs. Runoff is negligible to high and is influenced by micro-topography. Sites in lower areas on the landscape receive runoff whereas sites higher on the landscapes generate runoff. This can create differences in plant communities and disturbance regimes. Slopes typically range from 0 to 15 percent. The available water capacity is low to very high. Soils are shallow to very deep and well to excessively drained. Typical native plant species are fourwing saltbush *(Atriplex canescens)*, basin big sagebrush *(Artemisia tridentate spp. Tridentate)*, blue grama *(Boutaloua gracilis)*, Indian ricegrass *(Achnatherum hymenoides)*, sand dropseed *(Sporobolus cryptandrus)*, spike dropseed *(Sporobolus contractus)*, and tansymustard *(Descurainia Webb & Bethel).*

Figure 150.—R035XY218UT —Semidesert Sandy Loam (Blackbrush)

This ecological site occurs on structural benches and mesas. Runoff is high. Typically slopes range from 2 to 15 percent. The available water capacity is low. Soils on this site are moderately deep and well drained. Typical native plant species are blackbrush *(Coleogyne ramosissima)*, fourwing saltbush *(Atriplex canescens)*, shadscale saltbush *(Atriplex confertifolia)*, Torrey's tea *(Ephedra torreyana)*, Indian ricegrass *(Achnatherum hymenoides)*, needle and thread *(Hesperostipa comata)*, Jones' pepperweed *(lepidium montanum var. jonesii)*, and James' galleta *(Plueraphis jamesii).*

Figure 151.—R035XY233UT —Semidesert Shallow Sandy Loam (Blackbrush)

Typical landforms on which this ecological site occurs are structural benches and mesas. Runoff is very high. Slopes are generally low (1 to 6 percent). The available water capacity is very low. Soils are very shallow to shallow and well to excessively drained. Typical native plant species include blackbrush *(Coleogyne ramosissima)*, Mormon tea *(Ephedra viridis)*, plains pricklypear *(Opuntia polyacantha)*, larkspur *(Delphinium L.)*, scarlet globemallow *(Sphaeralcea coccinea)*, Jones' pepperweed *(Lepidium montanum var. jonesii)*, and sand dropseed *(Sporobolus cryptandrus).*

Figure 152.—R035XY235UT—Semidesert Very Shallow Gravelly Loam (Utah Juniper)

This ecological site occurs on structural benches and mesas. Runoff is very high. Slopes typically range from 2 to 30 percent. The soils of this site are gravelly, very shallow, and well drained. Available water capacity is very low. Typical native plant species associated with this site include Utah juniper *(Juniperus osteosperma)*, twoneedle pinyon *(Pinus edulis)*, blackbrush *(Coleogyne ramosissima)*, and roundleaf buffaloberry *(Sheperdia rotudnifolia)*.

Figure 153.—R035XY236UT —Semidesert Shallow Loam (Utah Juniper-Blackbrush)

This ecological site occurs on structural benches, ledges, and mesas. Runoff is very low to very high. The slope is generally 1 to 30 percent. The available water capacity is very low to low. Soils are very shallow to shallow and well to excessively drained. Typical native plant species include Utah juniper *(Juniperos osteosperma)*, twoneedle pinyon, blackbrush *(Coleogyne ramosissima)*, littleleaf mahogany *(Cercocarpus intricatus)*, Utah serviceberry *(Amelanchier utahensis)*, Fremont's mahonia *(Mahonia fremontii)*, and salina wildrye *(Leymus salinus).*

Figure 154.—R035XY263UT —Semidesert Very Steep Stony Loam (Utah Juniper-Pinyon)

This ecological site occurs on talus slopes. Runoff is medium to very high because of steep slopes. Slopes typically range from 30 to 70 percent. The available water capacity of this site is very low. Soils are very shallow to very deep and somewhat excessively drained. Typical native plant species associated with this site include Utah juniper *(Juniperous osteosperma)*, twoneedle pinyon *(Pinus edulis)*, bigelow sagebrush *(Artemisia bigelovii)*, blackbrush *(Coleogyne ramosissma)*, Utah serviceberry *(Amelachier utahensis)*, singleleaf ash *(Fraxinus anomala)*, salina wildrye *(Leymus salinus)*, James' galleta *(Pleuraphis jamesii)*, and Indian ricegrass *(Achnotherum hymenoides).*

Figure 155.—R035XY015UT—Sandy Bottom (Fourwing Saltbush)

This ecological site occurs on low floodplain steps. Runoff is low. Slopes typically range from 0 to 6 percent. The available water capacity of this site is high. Soils are very deep and somewhat poorly drained. Typical native plant species associated with this site include fourwing saltbush *(Atriplex canescens)*, sand sagebrush *(Artemisia filifolia)*, shadscale *(Atriplex confertifolia)*, James' galleta *(Phleuraphus jamesii)*, and Indian ricegrass *(Achnotherum hymenoides).*

Figure 156.—R035XY118—Desert Sandy Loam (Fourwing Saltbush)

This ecological site occurs on alluvial flats. Runoff is very low. Slopes typically range from 1 to 6 percent. The available water capacity of this site is very low. Soils are very deep and excessively drained. Typical native plant species associated with this site include fourwing saltbush *(Atriplex canescens)*, Torrey's jointfir *(Ephedra torreyana)*, winterfat *(Krascheninnikovia lanata)*, James' galleta *(Phleuraphus jamesii)*, and Indian ricegrass *(Achnotherum hymenoides).*

Land Management

In tables 9 through 12, interpretive ratings are given for various aspects of land management. The ratings are both verbal and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified land management practice. *Well suited* indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified forest management practice (1.00) and the point at which the soil feature is not a limitation (0.00).

Rating class terms for fire damage and seedling mortality are expressed as *low, moderate,* and *high*. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for fire damage or seedling mortality is highest (1.00) and the point at which the potential is lowest (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils for forest management practices. More detailed information about the criteria used in the ratings is available in the “National Forestry Manual,” which is available in local offices of the Natural Resources Conservation Service or on the Internet (http://nsscnt.nssc.nrcs.usda.gov/nfm/).

In table 9, ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, poorly suited, or unsuited to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column soil *rutting hazard* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of forest equipment. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

In table 10, ratings in the column *hazard of off-road or off-trail erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil

erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface)* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

In table 11, ratings in the columns *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, poorly suited, or unsuited to this mabagement activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, or poorly suited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

In table 12, ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading “Soil Properties.”

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this

section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for septic tank absorption fields and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Recreation

The soils of the survey area are rated in tables 13 and 14 according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season

when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in tables 13 and 14 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

In table 13, *camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

In table 14, foot traffic and equestrian trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain bike and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Tables 15 and 16 show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately

favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

In table 15, *dwellings* are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

In table 16, *local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may

restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Sanitary Facilities

Tables 17 shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

In table 17, *septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and

the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Construction Materials

Tables 18 and 19 give information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

In table 18, *sand* and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 18, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good, fair,* or *poor* as potential sources of sand and gravel. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good, fair,* or *poor* as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

In table 19, *reclamation material* is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by

its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 20 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

Engineering Index Properties

Table 21 gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2001) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2000).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages

are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of particle-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is generally omitted in the table.

Physical Properties

Table 22 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In table 22, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In table 22, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In table 22, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 or 1/10 bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential,

available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K-sat) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K-sat). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 22, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in table 22 as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting

their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Table 23 displays estimates of some of the more important values related to soil erodibility. Erosion Factor Kw, Erosion Factor Kf, Erosion Factor T, Wind Erodibility Group, and Wind Erodibility Index are shown for each layer of each soil component.

Chemical Properties

Table 24 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in

water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Water Features

Table 25 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 25 indicates, by month, depth to the top (upper limit) and base (lower limit) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. *Flooding* is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Frequency is estimated for both ponding and flooding. It is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

Table 26 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and

acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Table 27 shows those map unit characteristics related to soil development or pedogenesis – the climate, landform, geology, parent material, and vegetation. Column headers are: map symbol and soil name, percent of map unit (component composition), slope (range), elevation (range), MAP (mean annual precipitation range), landform, geology, parent material, and ecological site.

Formation of the Soils

The term "soil formation" refers to two processes that occur simultaneously in the environment. The first is the breakdown, through physical and chemical weathering, of consolidated material which is not capable of sustaining plants (rock) to a loose material capable of sustaining plant life (soil). The second is the subsequent development of soil horizons within the unconsolidated material, a process called pedogenesis.

Five major factors are recognized as working in concert to influence soil formation: parent material, climate, topography, biological factors, and time (Brady, 2002). The interactions of these five factors result in the wide variety of soils found throughout the world, as well as in any specific study area, such as Canyonlands National Park.

Parent material

Parent material is the unconsolidated material from which soils develop, through chemical and physical weathering processes. The inherent properties of the parent material have a profound effect on the properties of the soils that subsequently develop. In general, the more arid the climate, the more influence parent material has on soils. In Canyonlands, four distinct parent materials are involved in the soil formation process: eolian material, alluvium, colluvium, and residuum.

Nearly all of the soils mapped within Canyonlands National Park form in materials that have moved into place from elsewhere; the distances travelled by these materials may be many hundreds of miles or only a few feet. One of the major parent materials of soils in Canyonlands is eolian, or wind-blown, material (fig. 157). This material is composed primarily of fine sand. The eolian soils that develop from this material are the result of episodic deposition over a long period of time; some nearby samples in Canyonlands National Park have been dated to 46,000 years ago, with depositional events continuing up to the present day in varying degrees of intensity (Reynolds et al., 2006). The eolian soils have characteristics that reflect their origins; most are reddish brown in color, have sandy textures, and have very few coarse fragments within the soil profile. These eolian soils occur on mesa tops and, to a lesser extent, in the canyons in the Park. They vary in depth from a few inches to many feet.

The second parent material found within Canyonlands is alluvium, or water-deposited material. These soils are found in the bottoms of canyons and drainageways within the Park. Sediments along waterways such as these canyons and drainageways have different textures, depending on whether the water moves quickly or slowly. Fast-moving water leaves gravel, rocks, and sand. Slow-moving water leaves fine textured material (clay and silt) when sediments in the water settle out. This wide variety of materials is found within the Park. Most of the floodplain and terrace soils along the Green and Colorado rivers are comprised of various sand layers, with some loam and silt layers present as well (fig. 158). Water-borne gravels, cobbles, and stones can be seen in the lower parts of Cataract Canyon, testament to the occasional torrents that rage through the narrow waterway.

The third parent material is colluvium, or material transported by gravity. In the Park, colluvium is found on talus slopes and scarp slopes (fig. 159). Wingate and Kayenta Formations sandstones are the source for the colluvial deposits directly below the mesa of Island in the Sky and in the northern part of the Maze, below The Spur and above the White Rim. Organ Rock Shale and Moenkopie Formation sandstone are the source material for many of the soils on scarp slopes above the Land of the Standing Rocks and some areas below the White Rim. The scarp slopes directly above the Green and Colorado Rivers have areas of colluvial soils derived from Halgaito Shale, Honaker Trail, and Paradox Formations. Organ Rock Shale, Cedar Mesa Formation sandstone, and White Rim formation sandstone all contribute to the colluvial soils on the escarpments directly beneath the White Rim in Island in the Sky and the Maze Districts. The soils that develop from colluvium reflect the characteristics of the parent material; they usually have many rocks, ranging from gravels to boulders, throughout the profiles and on the surface. The textures of the soils depend largely upon the geological origin of the colluvial material. A sandstone such as Wingate Formation usually develops into a sandy soil. Soils developed from the Organ Rock Formation shale and Moenkopie Formation sandstones have loamier textures, reflecting the differences in the materials that made up the formations.

Few soils weather directly from the underlying rocks. These "residual" soils have the same general chemistry as the original rocks. A few soils in Canyonlands National Park are primarily residual, whereas many more often have a minor residual component in the lower portion of their profile. The Goblin soils in map unit 95 are residual. They are developed in place from the Schnabkaib Member of Moenkopie Formation sandstone. They reflect the color, texture, and high gypsum content of the rock formation from which they developed (fig. 160).

Figure 157.—Eolian (wind-blown) sand is a common parent material in Canyonlands National Park.

Figure 158.—A soil formed in alluvium (material transported by water). The different colored layers represent materials deposited during separate flood events; some layers are sandy, some silty.

Climate

Soils vary, depending on the climate. Temperature and moisture amounts cause different patterns of weathering and leaching. Especially in arid regions, wind redistributes sand and other particles. The amount, intensity, timing, and kind of precipitation influence soil formation. Seasonal and daily changes in temperature affect moisture effectiveness, biological activity, rates of chemical reactions, and kinds of vegetation (USDA, Soil Formation and Classification, 2009).

In Canyonlands National Park, the annual mean precipitation is approximately 9 inches, but the annual precipitation can range from 5 to 13 inches. Much of the rainfall occurs as convective storms in late summer; about 10 to 30 percent of the total precipitation falls in July and August. Snowpacks are generally light and not persistent throughout the winter. The average annual temperature ranges from 38 to 71 degrees F. The frost-free (<32°F) period averages 170 to 185 days and ranges from 160 to 195 days. The soil temperature regime is mesic, and the soil moisture regimes are aridic ustic and typic aridic.

The cool temperatures and short frost-free period in Canyonlands affect soil development (fig. 161). Areas of the world that are warmer and wetter have

Figure 159.—A scarp slope covered in colluvium (material transported downward by gravity) in the Maze District.

Figure 160.—A soil formed in residuum (weathered in place from the underlying rock). The light-colored material in this soil is gypsum, a salt inherited directly from the rock from which the soil formed.

Mean Annual Precipitation (MAP), Mean Annual Air Temperature (MAAT), and Frost-Free Days (FFD)

Canyonlands National Park

Temp Regime	Moisture Regime	MAP MAAT (English)	MAP MAAT (Metric)	Frost-Free Days
Mesic	Typic Aridic	5-7-9 inches 53-56-59 degrees F	127-178-229 mm 11.7-13.3-15 degrees C	175-185-195 days
Mesic	Ustic Aridic	9-10-13 inches 50-53-56 degrees F	229-254-330 mm 10-11.7-13.3 degrees C	160-170-180 days

Figure 161.—Summary of climate concepts applied to the Canyonlands National Park Soil Survey.

accelerated rates of biochemical reactions, chemical weathering, plant growth and decomposition, and other factors that affect soil development. Cooler, drier climates such as are present in the Park result in soils with comparatively less soil development, or pedogenesis.

The relatively low precipitation received in Canyonlands is also reflected in the degree of soil development. The precipitation received is sufficient to facilitate translocation of materials through the soil profile, such as salts and clays. These materials collect at the approximate wetting front in the soil profile, or the depth to which soil moisture generally penetrates each year. Consequently, we can observe calcic horizons in some soils (fig. 162); these horizons are zones of calcium carbonate accumulation, characterized by lighter color and a strong reaction to cold dilute hydrochloric acid. Calcic horizon designations contain the letter “k,” such as Bk. (The Sazi soil is an example.) In an area where precipitation is higher than that of Canyonlands, this calcic layer would be pushed deeper down through the soil. In very high precipitation zones, all carbonates and other salts would be leached completely from the profile.

Precipitation also greatly influences the weathering and translocation of clays downward through the soil profile. Cambic horizons, denoted by the horizon designation Bw, are zones of some pedogenic activity, such as development of structure and/or alteration of color, but no significant accumulation of carbonates or clay. Begay soils are examples of soils that have cambic horizons.

Topography

Slope and aspect affect the moisture and temperature of soil. Steep slopes facing the sun are warmer, just like the south-facing side of a house. Steep soils may be eroded and lose their topsoil as they form. Thus, they may be thinner than the more nearly level soils that receive deposits from areas upslope.

In Canyonlands National Park, the effects of topography on soil development may be seen in a comparison of steeper slopes with areas of more gentle slopes. Soils on steep areas such as talus slopes, scarp slopes, and hillslopes (fig. 163) usually lack an A horizon, or surface zones of structure and organic matter accumulation; topography plays a role in this as erosion and gravity continually remove the top layers of the soil. Soils on gentler slopes are often stable enough to develop an A horizon (fig. 164), and develop structure as well as other evidence of pedogenesis.

Biological factors

Plants, animals, micro-organisms, and humans affect soil formation. Animals and micro-organisms mix soils and form burrows and pores. Plant roots open channels in the soils. Different types of roots have different effects on soils. Grass roots are “fibrous” near the soil surface and easily decompose, adding organic matter. Taproots open pathways through dense layers. Micro-organisms affect chemical exchanges

between roots and soil. Humans can mix the soil so extensively that the soil material is again considered parent material.

The native vegetation depends on climate, topography, and biological factors, plus many soil factors such as soil density, depth, chemistry, temperature, and moisture. Leaves from plants fall to the surface and decompose on the soil. Organisms decompose these leaves and mix them with the upper part of the soil. Trees and shrubs have large roots that may grow to considerable depths.

Time

Soil formation processes are continuous, and over time soils exhibit features that reflect the other forming factors. Soil formation processes are continuous. Recently deposited material, such as the deposition from a flood, exhibits no features from soil development activities. The previous soil surface and underlying horizons become buried. The time clock resets for these soils. Terraces above the active floodplain, while genetically similar to the floodplain, are older land surfaces and exhibit more development features.

Figure 162.—A soil with a prominent calcic horizon (zone of accumulation of calcium carbonate) beginning at 37 centimeters.

Figure 163.—Soils on steep hillslopes rarely develop "A" horizons (surface horizons of organic matter accumulation and soil structure) because of continuous erosion and sparse vegetation.

Figure 164.—A soil with an "A" horizon (surface horizon of organic matter accumulation and soil structure). These horizons are likely to develop in areas of gentle slope with adequate organic matter inputs from vegetation.

These soil forming factors continue to affect soils even on “stable” landscapes. Materials are deposited on their surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity. As a result of this ongoing process of soil movement, some soils have no recognizable “A” horizon, normally a zone of some organic matter accumulation and some structure development.

Areas more susceptible to surface removal include those areas with relatively less microbiotic crust (fig. 165) and areas that have a higher degree of slope, among other factors. Many “stable” areas, such as those with lower slopes, have well-developed subsurface horizons such as calcic or cambic horizons. Soils in these relatively stable areas that do not undergo the continuous erosion caused by steeper slopes have the time required to develop these subsurface horizons. Soils in less stable areas often have horizons closely reflective of the original parent material; these horizons are designated with a “C.” (The Mathis family soil is an example.) Soils in areas of steep colluvial slopes are susceptible to movement downslope by gravity and water; this frequent movement of the soil material impedes pedogenic development. Such subsurface horizon development requires time in place.

Figure 165.—Robust microbiotic crust helps to stabilize the soil, protecting it from wind and water erosion.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain, or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the

horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coppice dune. A small dune of fine grained soil material stabilized around shrubs or small trees.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement. On a desert surface, a layer of gravel or larger fragments that was emplaced by upward movement of the underlying sediments or that remains after finer particles have been removed by running water or the wind.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

First Raindrop Impact. A term used to describe ground cover; the probability of raindrop interception by a specific category of cover (plant canopy, litter, rock fragments, cyanobacteria crust, lichen crust, moss crust, salt crust, gypsum crust, bare soil).

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graben. An elongate, relatively depressed landform unit that is bounded on faults on both sides (Bates, 1984)

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hard to reclaim (in tables). Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Head out. To form a flower head.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Ksat. Saturated hydraulic conductivity. (See Permeability.)

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,*and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Paleoterrace. An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0,015 inch
Very slow	0.0,015 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is

considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water. The runoff values in this survey were assigned using locally-derived criteria (fig.166).

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet.

RUNOFF

SURFACE RUNOFF - Surface runoff (Hortonian flow, overland flow) is the flow of water from an area that occurs over the surface of the soil. Surface runoff differs from internal flow or throughflow that results when infiltrated water moves laterally or vertically within a soil, above the water table. "The Index (of) Surface Runoff Classes" are relative estimates of surface runoff based on slope gradient and saturated hydraulic conductivity (K_{sat}). This index is specific to the following conditions (Soil Survey Staff, 1993).

- The soil surface is assumed to be bare.
- The soil is free of ice.
- Retention of water by ground surface irregularities is negligible or low.
- Infiltration is assumed to be at the steady ponded infiltration stage.
- Water is added to the soil by precipitation or snowmelt that yields 50 mm in 24 hours with no more than 25 mm in any 1-hour period.
- Antecedent soil water state is assumed to be very moist or wet to: a) the base of the solum; b) a depth of 1/2 m; or c) through the horizon that has the minimum K_{sat} within the top 1 meter; whichever is the least depth.

Use the following table and the above conditions to estimate "The Index (of) Surface Runoff Class" for the site. If seasonal or permanent, internal free-water occurs a depth of ≤ 50 cm (very shallow and shallow Internal Free-water classes), use a K_{sat} of *Very Low*. If seasonal or permanent, internal free-water is deeper than 50 cm, use the appropriate K_{sat} from the table. In PDP, if estimating runoff from vegetated areas, define and record under **User Defined Property**.

Index (of) Surface Runoff Classes						
	Saturated Hydraulic Conductivity (K_{sat}) Class [1]					
	Very High	High	Mod. High	Mod. Low	Low	Very Low
	cm / hour					
Slope Gradient Percent	≥ 36	3.6 to < 36	0.36 to < 3.6	0.036 to < 0.36	0.0036 to < 0.036	< 0.0036
Concave	N	N	N	N	N	N
< 1	N	N	N	L	M	H
1 to < 5	N	VL	L	M	H	VH
5 to < 10	VL	L	M	H	VH	VH
10 to < 20	VL	L	M	H	VH	VH
≥ 20	L	M	H	VH	VH	VH

[1] This table is based on the minimum K_{sat} occurring within 1/2 m of the soil surface. If the minimum K_{sat} for the soil occurs between 1/2 to 1 m, the runoff estimate should be reduced by one class (e.g., *Medium* to *Low*). If the minimum K_{sat} for the soil occurs below 1 meter, use the lowest K_{sat} class that occurs within 1 m of the surface.

Index (of) Surface Runoff Class Names	Code
Negligible	N
Very Low	VL
Low	L
Medium	M
High	H
Very High	VH

Figure 166.—Criteria used to determine "runoff" in this soil survey.

Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na+ to Ca++ Mg++. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes

of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Weathering. All physical and chemical changes produced in rocks or other deposits

at or near the earth’s surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Canyonlands, The Needle, UT1168)

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average		2 years in 10 will have--		Average	
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	number of growing degree days*	Average	Less than--	More than--	number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	40.7	16.1	28.4	59	-7	7	0.58	0.27	0.86	2	4.0
February---	48.9	22.8	35.9	67	0	37	0.39	0.13	0.62	1	2.1
March------	58.9	30.3	44.6	77	12	174	0.79	0.24	1.33	2	2.7
April------	67.3	36.6	52.0	85	19	355	0.72	0.20	1.20	2	0.6
May--------	77.7	45.7	61.7	93	28	658	0.66	0.14	1.11	2	0.0
June-------	89.3	55.0	72.1	103	35	952	0.32	0.01	0.53	1	0.0
July-------	95.0	61.7	78.3	105	48	1177	0.87	0.29	1.43	2	0.0
August-----	92.5	60.4	76.4	102	46	1098	0.93	0.30	1.59	2	0.0
September--	83.5	50.3	66.9	97	31	800	0.80	0.16	1.45	2	0.0
October----	69.8	37.9	53.9	88	21	425	1.17	0.25	2.11	3	0.3
November---	53.5	26.4	40.0	73	8	94	0.63	0.11	1.22	1	1.3
December---	42.6	17.8	30.2	60	-2	10	0.53	0.10	0.98	1	3.3
Yearly:											
Average---	68.3	38.4	53.4	---	---	---	---	---	---	---	14.3
Extreme---	107	-16	---	105	-10	---	---	---	---	---	---
Total-----	---	---	---	---	---	5786	8.40	6.57	9.83	21	

Average number of days with at least 1 inch of snow on the ground: 17

* See footnote at end of table.

Table 1.--Temperature and Precipitation--Continued

(Recorded in the period 1971-2000 at Canyonlands, The Neck, UT1168)

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average		2 years in 10 will have--		Average	
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	number of growing degree days*	Average	Less than--	More than--	number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	36.9	20.2	28.5	53	1	6	0.56	0.17	0.89	2	6.3
February---	43.9	25.9	34.9	61	5	33	0.42	0.15	0.66	1	2.4
March------	53.3	32.6	42.9	72	14	150	0.86	0.18	1.55	2	3.7
April------	62.1	38.8	50.5	80	21	328	0.81	0.19	1.39	2	2.0
May--------	72.7	48.3	60.5	90	28	632	0.79	0.22	1.35	2	0.2
June-------	84.4	59.3	71.9	98	37	953	0.41	0.00	0.74	1	0.0
July-------	90.2	65.1	77.6	100	50	1162	0.97	0.24	1.69	2	0.0
August-----	88.0	63.3	75.7	98	49	1100	0.77	0.24	1.31	2	0.0
September--	78.6	54.8	66.7	93	34	796	0.88	0.24	1.49	2	0.0
October----	64.9	43.1	54.0	83	21	440	1.31	0.38	2.15	3	0.9
November---	48.3	30.3	39.3	67	12	94	0.75	0.21	1.28	2	2.9
December---	37.7	21.4	29.6	53	3	6	0.56	0.23	0.90	2	5.1
Yearly:											
Average---	63.4	41.9	52.7	---	---	---	---	---	---	---	---
Extreme---	104	-13	---	101	-3	---	---	---	---	---	---
Total-----	---	---	---	---	---	5700	9.10	7.03	10.98	23	23.5

Average number of days with at least 1 inch of snow on the ground: 39

* See footnote at end of table.

Table 1.--Temperature and Precipitation--Continued

(Recorded in the period 1980-2000 at Arches National Park HQ, UT0336)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	oF	oF	oF	oF	oF	Units	In	In	In		In
January----	42.8	20.0	31.4	59	3	11	0.58	0.24	0.83	1	1.8
February---	50.9	26.7	38.8	70	7	69	0.44	0.15	0.73	1	0.9
March------	62.0	35.5	48.7	80	21	282	0.85	0.34	1.37	2	0.9
April------	70.2	41.9	56.1	89	27	483	0.84	0.19	1.45	2	0.0
May--------	81.0	51.1	66.1	97	36	808	0.74	0.15	1.22	2	0.0
June-------	92.3	60.4	76.4	106	45	1091	0.42	0.04	0.75	1	0.0
July-------	98.2	66.9	82.6	109	55	1320	0.86	0.24	1.50	2	0.0
August-----	96.3	66.1	81.2	107	54	1277	0.99	0.42	1.57	2	0.0
September--	86.8	55.6	71.2	101	39	935	0.77	0.29	1.16	2	0.0
October----	72.7	41.8	57.2	91	26	536	1.32	0.36	2.30	2	0.0
November---	55.8	30.8	43.3	74	17	145	0.67	0.14	1.25	2	0.4
December---	44.1	22.3	33.2	61	7	14	0.46	0.18	0.72	1	2.1
Yearly:											
Average---	71.1	43.3	57.2	---	---	---	---	---	---	---	---
Extreme---	112	-8	---	109	1	---	---	---	---	---	---
Total-----	---	---	---	---	---	6970	8.94	6.78	10.76	20	6.1

Average number of days with at least 1 inch of snow on the ground: 14

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.—Freeze Dates in Spring and Fall

(Recorded in the period 1965-1990 at Canyonlands, The Needle, UT1168)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 26	May 11	May 24
2 years in 10 later than--	April 30	May 6	May 20
5 years in 10 later than--	April 9	April 26	May 11
First freezing temperature in fall:			
1 year in 10 earlier than--	October 15	October 5	September 21
2 years in 10 earlier than--	October 20	October 9	September 27
5 years in 10 earlier than--	October 31	October 18	October 7

Table 2.—Freeze Dates in Spring and Fall—-Continued

(Recorded in the period 1965-1990 at Canyonlands, The Neck, UT1168)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 24	May 14	May 18
2 years in 10 later than--	April 17	May 6	May 13
5 years in 10 later than--	April 3	April 21	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 25	October 15	September 29
2 years in 10 earlier than--	October 31	October 21	October 5
5 years in 10 earlier than--	November 12	November 1	October 18

Table 2.--Freeze Dates in Spring and Fall--Continued

(Recorded in the period 1980-2008 at Arches National Park HQ, UT0336)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 25	April 20	April 30
2 years in 10 later than--	March 12	April 13	April 26
5 years in 10 later than--	March 4	March 30	April 14
First freezing temperature in fall:			
1 year in 10 earlier than--	October 30	October 15	October 11
2 years in 10 earlier than--	November 3	October 24	October 13
5 years in 10 earlier than--	November 18	November 6	October 24

Table 3.—Growing Season

(Recorded in the period 1971-2000 at Canyonlands, The Needle, UT1168)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	182	155	124
8 years in 10	193	166	135
5 years in 10	215	187	156
2 years in 10	237	208	178
1 year in 10	248	219	189
(Recorded in the period 1971-2000 at Canyonlands, The Neck, UT1168)			
9 years in 10	193	167	145
8 years in 10	202	177	153
5 years in 10	219	196	169
2 years in 10	236	215	184
1 year in 10	245	225	192
(Recorded in the period 1980-2000 at Arches National Park, UT0336)			
9 years in 10	229	195	172
8 years in 10	237	205	181
5 years in 10	252	224	198
2 years in 10	267	243	215
1 year in 10	275	253	224

Table 4.--Taxonomic Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Arches	Mixed, mesic Lithic Torripsamments
Batterson	Sandy, mixed, mesic Lithic Ustic Torriorthents
*Bebeevar	Mixed, mesic Oxyaquic Torripsamments
Begay	Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids
Bluechief	Coarse-loamy, mixed, superactive, mesic Typic Haplocalcids
Bluechief family	Coarse-loamy, mixed, superactive, mesic Typic Haplocalcids
*Goblin	Loamy-skeletal, gypsic, mesic Lithic Haplogypsids
Green River family	Coarse-loamy, mixed, superactive, calcareous, mesic Oxyaquic Torrifluvents
Ignacio	Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids
Mathis family	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Mellenthin	Loamy-skeletal, mixed, superactive, mesic Lithic Ustic Haplocalcids
Mido	Mixed, mesic Ustic Torripsamments
Mido family	Mixed, mesic Ustic Torripsamments
Moenkopie	Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Monue	Coarse-loamy, mixed, superactive, mesic Typic Haplocambids
Nalcase	Siliceous, mesic Lithic Torripsamments
Needle	Mixed, mesic Lithic Torripsamments
Nepalto	Sandy-skeletal, mixed, mesic Typic Torriorthents
Pensom	Mixed, mesic Ustic Torripsamments
Reef	Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Rizno	Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Sazi	Coarse-loamy, mixed, superactive, mesic Ustic Haplocalcids
Sheppard family	Mixed, mesic Typic Torripsamments
Torriorthents	Torriorthents
Trail	Sandy, mixed, mesic Typic Torrifluvents
Tsaya	Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents
Tsaya family	Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents
Wayneco family	Loamy, mixed, superactive, mesic Lithic Ustic Haplocalcids

Table 5.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
90	Arches-Rock outcrop complex, 2 to 15 percent slopes	6,721	2.0
91	Arches-Mido-Rock outcrop complex, 2 to 15 percent slopes	21,018	6.2
92	Begay, bedrock substratum-Mido complex, 2 to 6 percent slopes	3,236	1.0
93	Begay-Ignacio complex, 2 to 10 percent slopes	709	0.2
94	Bluechief-Needle complex, 2 to 15 percent slopes	3,245	1.0
95	Goblin very gravelly sandy loam, 6 to 45 percent slopes	363	0.1
96	Green River family-Bebeevar complex, 0 to 6 percent slopes	3,572	1.1
97	Mathis family-Rock outcrop-Rizno complex, 15 to 70 percent slopes, bouldery	11,419	3.4
98	Mellenthin-Wayneco family complex, 1 to 6 percent slopes	750	0.2
99	Mido family, occasionally flooded-Green River family complex, 0 to 6 percent slopes	3,504	1.0
100	Mido family, sodic, 0 to 8 percent slopes	550	0.2
101	Mido fine sand, 0 to 6 percent slopes	3,447	1.0
102	Mido fine sand, 2 to 15 percent slopes	866	0.3
103	Mido-Batterson-Rock outcrop complex, 2 to 15 percent slopes	9,021	2.7
104	Mido-Begay complex, 0 to 6 percent slopes	9,878	2.9
105	Mido-Mido family, frequently flooded, complex, 1 to 15 percent slopes	2,870	0.9
106	Monue-Trail-Nepalto complex, 1 to 6 percent slopes	1,980	0.6
107	Pensom-Mido complex, 2 to 30 percent slopes	1,596	0.5
108	Reef-Rock outcrop complex, 2 to 30 percent slopes	4,434	1.3
109	Reef-Rock outcrop complex, 30 to 60 percent slopes, extremely bouldery	9,691	2.9
110	Rizno-Ignacio complex, 2 to 15 percent slopes	4,401	1.3
111	Rizno-Rock outcrop complex, 1 to 25 percent slopes	10,440	3.1
112	Rizno-Rock outcrop complex, 2 to 15 percent slopes	1,518	0.4
113	Rock outcrop-Arches complex, 2 to 15 percent slopes	24,811	7.3
114	Rock outcrop-Arches complex, 2 to 60 percent slopes	51,471	15.2
115	Rock outcrop-Nalcase complex, 2 to 15 percent slopes	4,268	1.3
116	Rock outcrop-Needle complex, 2 to 30 percent slopes	6,535	1.9
117	Rock outcrop-Torriorthents complex, 20 to 65 percent slopes, extremely bouldery	6,332	1.9
118	Rock outcrop-Tsaya complex, 15 to 60 percent slopes, extremely bouldery	52,983	15.7
119	Sazi-Rizno complex, 2 to 15 percent slopes	9,509	2.8
120	Sheppard-Tsaya-Bluechief families complex, 2 to 15 percent slopes	2,199	0.7
121	Torriorthents-Rock outcrop-Badland complex, 4 to 70 percent slopes, extremely boudery	10,565	3.1
122	Torriorthents-Rock outcrop complex, 35 to 70 percent slopes, extremely bouldery	19,319	5.7
123	Tsaya family-Moenkopie complex, 2 to 15 percent slopes	29,553	8.8
124	Tsaya family-Rock outcrop complex, 35 to 80 percent slopes	242	*
125	Water	4,582	1.4
	Total	337,598	100.0

* Less than 0.1 percent.

Table 6.--Ecological sites and characteristic plant communities

[Composition of forest understory based on understory productivity; range site composition is based on percent dry weight. Forest understory is defined as production less than or equal to 13 feet in height. Characteristic plants are pulled from the component existing plants table in the National Soils Information System (NASIS). Absence of an entry indicates the species totaled less than one percent of annual production.]

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production		Characteristic plants	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/ac		Pct	Pct
90:						
Arches - 65%----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	400	blackbrush		45
		Normal	300	Utah juniper		25
		Unfavorable	200	twoneedle pinyon		25
				broom snakeweed		2
				Indian ricegrass		1
91:						
Arches - 30%----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	300	blackbrush		35
		Normal	250	Utah juniper		20
		Unfavorable	200	broom snakeweed		10
				pinyon		10
				fourwing saltbush		5
				galleta		4
Mido - 30%------	Semidesert Sand (Blackbrush) (R035XY210UT)	Favorable	350	blackbrush		30
		Normal	200	Utah juniper		15
		Unfavorable	150	broom snakeweed		10
				fourwing saltbush		10
				pinyon		5
				galleta		3
92:						
Begay - 50%-----	Semidesert Sandy Loam (Fourwing Saltbush) (R035XY215UT)	Favorable	900	needle and thread		20
		Normal	450	Indian ricegrass		15
		Unfavorable	150	broom snakeweed		10
				blue grama		8
				fourwing saltbush		6
				Cutler Mormon tea		5
				plains pricklypear		5
				gilia		4
Mido - 40%------	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	800	needle and thread		30
		Normal	400	Indian ricegrass		20
		Unfavorable	200	blue grama		10
				fourwing saltbush		10
				broom snakeweed		8
				Cutler Mormon tea		7
93:						
Begay - 50%-----	Semidesert Sandy Loam (Fourwing Saltbush) (R035XY215UT)	Favorable	450	needle and thread		35
		Normal	350	Indian ricegrass		20
		Unfavorable	250	blue grama		15
				sandhill muhly		10
				Cutler Mormon tea		5
				fourwing saltbush		5
Ignacio - 30%---	Semidesert Sandy Loam (Fourwing Saltbush) (R035XY215UT)	Favorable	500	needle and thread		50
		Normal	400	Indian ricegrass		20
		Unfavorable	300	blue grama		15
				Cutler Mormon tea		5
				fourwing saltbush		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production: Kind of year	Total production: Dry weight	Characteristic plants	Composition: Forest	Composition: Range
			Lb/ac		Pct	Pct
94:						
Bluechief - 45%-	Desert Sandy Loam (Blackbrush) (R035XY121UT)	Favorable	400	blackbrush		45
		Normal	250	Indian ricegrass		35
		Unfavorable	75	galleta		15
				Torrey Mormon tea		5
Needle - 40%----	Desert Shallow Sandy Loam (Blackbrush) (R035XY133UT)	Favorable	300	blackbrush		25
		Normal	200	rubber rabbitbrush		20
		Unfavorable	100	Indian ricegrass		10
				Douglas rabbitbrush		5
				Torrey Mormon tea		5
				broom snakeweed		5
				desert trumpet buckwheat		5
				galleta		5
				gooseberryleaf globemallow		5
95:						
Goblin - 90%----	Desert Very Shallow Gypsum (Torrey's Jointfir) (R035XY142UT)	Favorable	100	shadscale saltbush		24
		Normal	75	rubber rabbitbrush		23
		Unfavorable	50	galleta		20
				Torrey Mormon tea		15
				scarlet globemallow		5
				buckwheat		4
96:						
Green River Family - 75%---	Semiwet Fresh Streambank (Fremont Cottonwood) (R035XY013UT)	Favorable	1200	tamarisk		50
		Normal	1000	halogeton		15
		Unfavorable	800	russian thistle		15
				Fremont cottonwood		10
				desert olive		5
Bebeevar - 20%--	Sandy Bottom (Fourwing Saltbush) (R035XY015UT)	Favorable	500	russian thistle		25
		Normal	400	cheatgrass		20
		Unfavorable	300	Fremont cottonwood		15
				fourwing saltbush		10
				seepweed		10
				tamarisk		10
				scarlet globemallow		5
97:						
Mathis Family - 45%------------	Semidesert Very Steep Stony Loam (Pinyon-Utah Juniper) (R035XY263UT)	Favorable	350	sumac		18
		Normal	250	Salina Wildrye		17
		Unfavorable	150	snowberry		12
				Douglas rabbitbrush		10
				Indian ricegrass		10
				Utah juniper		10
				twoneedle pinyon		10
Rizno - 15%-----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	200	Salina Wildrye		30
		Normal	150	Bigelow sagebrush		20
		Unfavorable	100	Indian ricegrass		18
				Utah juniper		10
				twoneedle pinyon		10
				green Mormon tea		3

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production		Characteristic plants	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/ac		Pct	Pct
98:						
Mellenthin - 50%	Semidesert Shallow Sandy Loam (Blackbrush) (R035XY233UT)	Favorable	300	blackbrush		80
		Normal	200	Utah juniper		3
		Unfavorable	100	Torrey Mormon tea		1
Wayneco Family - 35%-----------	Semidesert Shallow Sandy Loam (Blackbrush) (R035XY233UT)	Favorable	300	blackbrush		75
		Normal	200	Fremont's mahonia		6
		Unfavorable	100	Jones's pepperweed		3
				Indian ricegrass		2
				Torrey Mormon tea		2
				green Mormon tea		2
99:						
Mido Family - 70%-----------	Loamy Bottom (Basin Big Sagebrush) (R035XY011UT)	Favorable	750	tamarisk		50
		Normal	500	basin big sagebrush		25
		Unfavorable	350	Louisiana sagewort		10
				tansymustard		5
Green River Family - 15%---	Semiwet Fresh Streambank (Fremont Cottonwood) (R035XY013UT)	Favorable	4000	Fremont cottonwood		25
		Normal	2500	coyote willow		20
		Unfavorable	1500	willow		20
				Baltic rush		10
				bluegrass		5
				field horsetail		5
				groundsel		5
				tamarisk		5
100:						
Mido Family - 70%-----------	Alkali Bottom (Greasewood) (R035XY003UT)	Favorable	1200	greasewood		25
		Normal	1000	fourwing saltbush		15
		Unfavorable	800	spike dropseed		15
				Indian ricegrass		10
				sand dropseed		10
				seepweed		5
101:						
Mido - 90%------	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	500	sand dropseed		30
		Normal	400	Indian ricegrass		20
		Unfavorable	200	russian thistle		20
				fourwing saltbush		15
				cheatgrass		5
				sand sagebrush		5
				tansymustard		5
102:						
Mido - 95%------	Semidesert Sand (Blackbrush) (R035XY210UT)	Favorable	350	blackbrush		60
		Normal	250	Torrey Mormon tea		10
		Unfavorable	150	buckwheat		10
				Indian ricegrass		5
				fourwing saltbush		3
103:						
Mido - 35%------	Semidesert Sand (Blackbrush) (R035XY210UT)	Favorable	550	blackbrush		50
		Normal	500	fourwing saltbush		10
		Unfavorable	450	Cutler Mormon tea		5
				Indian ricegrass		5
				Utah juniper		5
				needle and thread		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production: Kind of year	Total production: Dry weight	Characteristic plants	Composition: Forest	Composition: Range
			Lb/ac		Pct	Pct
103:						
Batterson - 30%-	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	250	blackbrush		25
		Normal	200	Utah juniper		20
		Unfavorable	150	pinyon		20
				roundleaf buffaloberry		10
				fourwing saltbush		5
				galleta		3
104:						
Mido - 65%------	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	500	Indian ricegrass		30
		Normal	400	galleta		20
		Unfavorable	300	fourwing saltbush		15
				purple threeawn		10
				winterfat		10
Begay - 30%-----	Semidesert Sandy Loam (Fourwing Saltbush) (R035XY215UT)	Favorable	600	galleta		25
		Normal	400	fourwing saltbush		20
		Unfavorable	200	Indian ricegrass		10
				winterfat		10
				rubber rabbitbrush		8
				stickseed		8
				cheatgrass		5
105:						
Mido - 65%------	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	500	sand sagebrush		24
		Normal	400	Indian ricegrass		15
		Unfavorable	300	fourwing saltbush		15
				sand dropseed		15
				needle and thread		10
				gooseberryleaf globemallow		5
Mido Family - 15%------------	Semiwet Fresh Streambank (Fremont Cottonwood) (R035XY013UT)	Favorable	1500	Fremont cottonwood		20
		Normal	1000	desert saltgrass		20
		Unfavorable	500	sand dropseed		10
				rubber rabbitbrush		8
				horsetail		3
106:						
Monue - 30%-----	Alkali Bottom (Greasewood) (R035XY003UT)	Favorable	700	sand dropseed		30
		Normal	600	greasewood		25
		Unfavorable	500	seepweed		20
				fourwing saltbush		10
				Indian ricegrass		5
				russian thistle		5
Trail - 30%-----	Desert Sandy Loam (Fourwing Saltbush) (R035XY118UT)	Favorable	200	seepweed		45
		Normal	100	fourwing saltbush		25
		Unfavorable	50	plains pricklypear		10
				russian thistle		10
Nepalto - 25%---	Desert Stony Loam (Shadscale-Bud Sagebrush) (R035XY136UT)	Favorable	350	sand sagebrush		30
		Normal	250	shadscale saltbush		20
		Unfavorable	150	Indian ricegrass		10
				sand dropseed		10
				Torrey Mormon tea		5
				galleta		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production		Characteristic plants	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/ac		Pct	Pct
107:						
Pensom - 45%----	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	800	sand dropseed		30
		Normal	400	Indian ricegrass		20
		Unfavorable	200	needle and thread		15
				sandhill muhly		10
				Cutler Mormon tea		5
				plains pricklypear		3
				gooseberryleaf globemallow		2
Mido - 40%------	Semidesert Sand (Fourwing Saltbush) (R035XY212UT)	Favorable	800	sand dropseed		30
		Normal	400	Indian ricegrass		20
		Unfavorable	200	needle and thread		15
				sandhill muhly		10
				Cutler Mormon tea		5
				plains pricklypear		3
				gooseberryleaf globemallow		2
108:						
Reef - 60%------	Semidesert Very Shallow Gravelly Loam (Utah Juniper) (R035XY235UT)	Favorable	250	blackbrush		40
		Normal	200	Utah juniper		15
		Unfavorable	150	pinyon		15
				roundleaf buffaloberry		8
				galleta		5
				rubber rabbitbrush		5
109:						
Reef - 65%------	Semidesert Very Steep Stony Loam (Pinyon-Utah Juniper) (R035XY263UT)	Favorable	300	singleleaf ash		25
		Normal	250	Utah juniper		20
		Unfavorable	200	Utah serviceberry		13
				Desert Princesplume		10
				sumac		10
				desert needlegrass		5
110:						
Rizno - 50%-----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	350	blackbrush		50
		Normal	250	Utah juniper		10
		Unfavorable	150	singleleaf ash		8
				galleta		7
				broom snakeweed		5
				twoneedle pinyon		5
Ignacio - 35%---	Semidesert Sandy Loam (Fourwing Saltbush) (R035XY215UT)	Favorable	600	Indian ricegrass		50
		Normal	500	sand dropseed		20
		Unfavorable	400	blue grama		10
				Cutler Mormon tea		5
				fourwing saltbush		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production: Kind of year	Total production: Dry weight	Characteristic plants	Composition: Forest	Composition: Range
			Lb/ac		Pct	Pct
111:						
Rizno - 60%-----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	400	blackbrush		35
		Normal	300	Utah juniper		25
		Unfavorable	200	twoneedle pinyon		10
				broom snakeweed		8
				green Mormon tea		5
				plains pricklypear		5
112:						
Rizno - 40%-----	Semidesert Shallow Sandy Loam (Utah Juniper-Blackbrush) (R035XY236UT)	Favorable	500	Utah juniper		30
		Normal	300	twoneedle pinyon		25
		Unfavorable	150	broom snakeweed		20
				fourwing saltbush		10
				Mormon tea		5
				cliffrose		5
				plains pricklypear		5
113:						
Arches - 25%----	Shallow Sand Rock Pocket (Utah Juniper/Pinyon) (R035XY019UT)	Favorable	500	pinyon		18
		Normal	400	littleleaf mountain-mahogany		15
		Unfavorable	300			
				Utah juniper		12
				blackbrush		10
				needle and thread		10
				singleleaf ash		10
				galleta		8
				purple threeawn		8
114:						
Arches - 15%----	Shallow Sand Rock Pocket (Utah Juniper/Pinyon) (R035XY019UT)	Favorable	500	blackbrush		10
		Normal	300	Utah juniper		3
		Unfavorable	100	twoneedle pinyon		3
				broom snakeweed		2
				Indian ricegrass		1
				galleta		1
				singleleaf ash		1
115:						
Nalcase - 25%---	Shallow Sand Rock Pocket (Utah Juniper/Pinyon) (R035XY019UT)	Favorable	300	littleleaf mountain-mahogany		30
		Normal	200			
		Unfavorable	100	twoneedle pinyon		15
				Bigelow sagebrush		10
				Utah juniper		5
				bottlebrush squirreltail		5
				broom snakeweed		5
				purple threeawn		5
				singleleaf ash		5
116:						
Needle - 35%----	Shallow Sand Rock Pocket (Utah Juniper/Pinyon) (R035XY019UT)	Favorable	500	blackbrush		42
		Normal	300	singleleaf ash		13
		Unfavorable	100	Indian ricegrass		10
				Utah juniper		9
				broom snakeweed		5
				galleta		5
				twoneedle pinyon		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production Kind of year	Total production Dry weight	Characteristic plants	Composition Forest	Composition Range
			Lb/ac		Pct	Pct
117:						
Torriorthents - 45%------------	Desert Very Steep Stony Loam (Shadscale) (R035XY146UT)	Favorable	50	galleta		30
		Normal	20	pepperweed		25
		Unfavorable	10	skunkbush sumac		20
				Desert Princesplume		15
				Torrey Mormon tea		10
118:						
Tsaya - 45%-----	Desert Very Steep Stony Loam (Shadscale) (R035XY146UT)	Favorable	300	shadscale saltbush		16
		Normal	200	desert needlegrass		15
		Unfavorable	100	galleta		15
				cheatgrass		10
				Desert Princesplume		8
				broom snakeweed		8
				purple threeawn		8
				crispleaf buckwheat		5
119:						
Sazi - 50%------	Semidesert Sandy Loam (Blackbrush) (R035XY218UT)	Favorable	300	blackbrush		29
		Normal	250	galleta		15
		Unfavorable	200	Desert Princesplume		14
				scarlet globemallow		13
				shadscale saltbush		10
				Indian ricegrass		5
				broom snakeweed		5
Rizno - 30%-----	Semidesert Shallow Sandy Loam (Blackbrush) (R035XY233UT)	Favorable	300	blackbrush		47
		Normal	200	Desert Princesplume		15
		Unfavorable	100	galleta		10
				shadscale saltbush		10
				Torrey's jointfir		8
				Indian ricegrass		3
120:						
Sheppard Family - 30%----------	Desert Sandy Loam (Blackbrush) (R035XY121UT)	Favorable	350	blackbrush		50
		Normal	250	Indian ricegrass		10
		Unfavorable	150	shadscale saltbush		10
				Torrey Mormon tea		5
				desert trumpet buckwheat		5
				galleta		5
Tsaya Family - 30%------------	Desert Shallow Sandy Loam (Blackbrush) (R035XY133UT)	Favorable	150	blackbrush		45
		Normal	100	Torrey Mormon tea		10
		Unfavorable	50	galleta		10
				Brenda's yellow cryptantha		5
				broom snakeweed		5
				rubber rabbitbrush		5
Bluechief Family - 20%----------	Desert Sandy Loam (Blackbrush) (R035XY121UT)	Favorable	350	blackbrush		50
		Normal	250	Indian ricegrass		10
		Unfavorable	150	shadscale saltbush		10
				Torrey Mormon tea		5
				desert trumpet buckwheat		5
				galleta		5

Table 6.--Ecological sites and characteristic plant communities--Continued

Map unit symbol soil name - % of map unit	Ecological site name and number	Total production: Kind of year	Total production: Dry weight	Characteristic plants	Composition: Forest	Composition: Range
			Lb/ac		Pct	Pct
121:						
Torriorthents - 45%-----------	Desert Very Steep Stony Loam (Shadscale) (R035XY146UT)	Favorable	150	shadscale saltbush		60
		Normal	100	desert trumpet buckwheat		10
		Unfavorable	50	Desert Princesplume		8
				Torrey Mormon tea		8
				aster		5
122:						
Torriorthents - 50%-----------	Desert Very Steep Stony Loam (Shadscale) (R035XY146UT)	Favorable	100	needle and thread		20
		Normal	60	galleta		15
		Unfavorable	10	mat saltbush		15
				roundleaf buffaloberry		15
				green Mormon tea		10
				Utah juniper		6
				fourwing saltbush		5
123:						
Tsaya Family - 50%-----------	Desert Shallow Sandy Loam (Shadscale) (R035XY130UT)	Favorable	350	galleta		45
		Normal	250	shadscale saltbush		35
		Unfavorable	150	Torrey Mormon tea		10
Moenkopie - 40%-	Desert Shallow Sandy Loam (Shadscale) (R035XY130UT)	Favorable	300	shadscale saltbush		55
		Normal	200	galleta		20
		Unfavorable	100	cheatgrass		7
				Torrey Mormon tea		5
				broom snakeweed		4
				Indian ricegrass		3
124:						
Tsaya Family - 65%-----------	Desert Very Steep Stony Loam (Shadscale) (R035XY146UT)	Favorable	80	Utah juniper		20
		Normal	20	big galleta		20
		Unfavorable	10	Columbia needlegrass		15
				Indian ricegrass		10
				buckwheat		10
				skunkbush sumac		10
				Desert Princesplume		5
				Jones's pepperweed		5
				fourwing saltbush		5

Table 7.--Index of Plant Symbols, Common Names, and Scientific Names

Plants displayed occur within the National Soils Information System (NASIS) plant tables used for the soil survey area. The scientific and common names are referenced at the USDA PLANTS database: plants.usda.gov

Plant Symbol	Local Common Name	Scientific Name
ACHY	Indian ricegrass	Achnatherum hymenoides
ACSP12	desert needlegrass	Achnatherum speciosum
AMUT	Utah serviceberry	Amelanchier utahensis
ARBI3	Bigelow sagebrush	Artemisia bigelovii
ARFI2	sand sagebrush	Artemisia filifolia
ARLU	Louisiana sagewort	Artemisia ludoviciana
ARPU9	purple threeawn	Aristida purpurea
ARTRT	basin big sagebrush	Artemisia tridentata ssp. tridentata
ASTER	aster	Aster
ATCA2	fourwing saltbush	Atriplex canescens
ATCO	shadscale saltbush	Atriplex confertifolia
ATCO4	mat saltbush	Atriplex corrugata
BOGR2	blue grama	Bouteloua gracilis
BRTE	cheatgrass	Bromus tectorum
CEIN7	littleleaf mountain-mahogany	Cercocarpus intricatus
CHVI8	Douglas rabbitbrush	Chrysothamnus viscidiflorus
CORA	blackbrush	Coleogyne ramosissima
CRFL5	Brenda's yellow cryptantha	Cryptantha flava
DESCU	tansymustard	Descurainia
DISP	desert saltgrass	Distichlis spicata
ELEL5	bottlebrush squirreltail	Elymus elymoides
EPCU	Cutler Mormon tea	Ephedra cutleri
EPTO	Torrey Mormon tea	Ephedra torreyana
EPTO	Torrey's jointfir	Ephedra torreyana
EPVI	Mormon tea	Ephedra viridis
EPVI	green Mormon tea	Ephedra viridis
EQAR	field horsetail	Equisetum arvense
EQUIS	horsetail	Equisetum
ERCO14	crispleaf buckwheat	Eriogonum corymbosum
ERIN4	desert trumpet buckwheat	Erigonum inflaturm
ERIOG	buckwheat	Eriogonum
ERNA10	rubber rabbitbrush	Ericameria nauseosa
FOPU2	desert olive	Forestiera shrevei
FRAN2	singleleaf ash	Fraxinus anomala
GILIA	gilia	Gilia
GUSA2	broom snakeweed	Gutierrezia sarothrae
HAGL	halogeton	Halogeton glomeratus
HECOC8	needle and thread	Hesperostipa comata ssp. comata
JUBA	Baltic rush	Juncus balticus
JUOS	Utah juniper	Juniperus osteosperma
KRLA2	winterfat	Krascheninnikovia lanata
LAPPU	stickseed	Lappula sp
LEMOJ	Jones's pepperweed	Lepidium montanum varr jonesii
LEPID	pepperweed	Lepidium
LESA4	Salina Wildrye	Leymus salinus
MAFR3	Fremont's mahonia	Mahonia fremontii
MUPU2	sandhill muhly	Muhlenbergia pungens
OPPO	plains pricklypear	Opuntia polyacantha
PIED	pinyon	Pinus edulis
PIED	twoneedle pinyon	Pinus edulis
PLJA	galleta	Pleuraphis jamesii
PLRI3	big galleta	
POA	bluegrass	Poa
POFR2	Fremont cottonwood	Populus fremontii
PUER2	cliffrose	Cowania
RHTR	skunkbush sumac	Rhus trilobata
RHUS	sumac	Rhus
SAEX	coyote willow	Salix exigua
SALIX	willow	Salix
SATR12	russian thistle	Salsola tragus
SAVE4	greasewood	Sarcobatus vermiculatus

Table 7.--Index of Plant Symbols, Common Names, and Scientific Names--Continued

Plant Symbol	Local Common Name	Scientific Name
SENEC	groundsel	Senecio
SHRO	roundleaf buffaloberry	Shepherdia rotundifolia
SPCO	scarlet globemallow	Sphaeralcea coccinea
SPCO4	spike dropseed	Sporobolus contractus
SPCR	sand dropseed	Sporobolus cryptandrus
SPGR2	gooseberryleaf globemallow	Sphaeralcea grossulariifolia
STCO3	Columbia needlegrass	Stipa columbiana
STPI	Desert Princesplume	Stanleya pinnata
SUAED	seepweed	Suaeda
SYMPH	snowberry	Symphoricarpos
TAMAR2	tamarisk	Tamarix

Table 8.—Index of Common Names, Plant Symbols, and Scientific Names

Plants displayed occur within the National Soils Information System (NASIS) plant tables used for the soil survey area. The scientific and common names are referenced at the USDA PLANTS database: plants.usda.gov

Local Common Name	Plant Symbol	Scientific Name
aster	ASTER	Aster
Baltic rush	JUBA	Juncus balticus
basin big sagebrush	ARTRT	Artemisia tridentata ssp. tridentata
big galleta	PLRI3	
Bigelow sagebrush	ARBI3	Artemisia bigelovii
blackbrush	CORA	Coleogyne ramosissima
blue grama	BOGR2	Bouteloua gracilis
bluegrass	POA	Poa
bottlebrush squirreltail	ELEL5	Elymus elymoides
Brenda’s yellow cryptantha	CRFL5	Cryptantha flava
broom snakeweed	GUSA2	Gutierrezia sarothrae
buckwheat	ERIOG	Eriogonum
cheatgrass	BRTE	Bromus tectorum
cliffrose	PUER2	Cowania
Columbia needlegrass	STCO3	Stipa columbiana
coyote willow	SAEX	Salix exigua
crispleaf buckwheat	ERCO14	Eriogonum corymbosum
Cutler Mormon tea	EPCU	Ephedra cutleri
desert needlegrass	ACSP12	Achnatherum speciosum
desert olive	FOPU2	Forestiera shrevei
Desert Princesplume	STPI	Stanleya pinnata
desert saltgrass	DISP	Distichlis spicata
desert trumpet buckwheat	ERIN4	Erigonum inflaturm
Douglas rabbitbrush	CHVI8	Chrysothamnus viscidiflorus
field horsetail	EQAR	Equisetum arvense
fourwing saltbush	ATCA2	Atriplex canescens
Fremont cottonwood	POFR2	Populus fremontii
Fremont’s mahonia	MAFR3	Mahonia fremontii
galleta	PLJA	Pleuraphis jamesii
gilia	GILIA	Gilia
gooseberryleaf globemallow	SPGR2	Sphaeralcea grossulariifolia
greasewood	SAVE4	Sarcobatus vermiculatus
green Mormon tea	EPVI	Ephedra viridis
groundsel	SENEC	Senecio
halogeton	HAGL	Halogeton glomeratus
horsetail	EQUIS	Equisetum
Indian ricegrass	ACHY	Achnatherum hymenoides
Jones’s pepperweed	LEMOJ	Lepidium montanum varr jonesii
littleleaf mountain-mahogany	CEIN7	Cercocarpus intricatus
Louisiana sagewort	ARLU	Artemisia ludoviciana
mat saltbush	ATCO4	Atriplex corrugata
Mormon tea	EPVI	Ephedra viridis
needle and thread	HECOC8	Hesperostipa comata ssp. comata
pepperweed	LEPID	Lepidium
pinyon	PIED	Pinus edulis
plains pricklypear	OPPO	Opuntia polyacantha
purple threeawn	ARPU9	Aristida purpurea
roundleaf buffaloberry	SHRO	Shepherdia rotundifolia
rubber rabbitbrush	ERNA10	Ericameria nauseosa
russian thistle	SATR12	Salsola tragus
Salina Wildrye	LESA4	Leymus salinus
sand dropseed	SPCR	Sporobolus cryptandrus
sand sagebrush	ARFI2	Artemisia filifolia
sandhill muhly	MUPU2	Muhlenbergia pungens
scarlet globemallow	SPCO	Sphaeralcea coccinea
seepweed	SUAED	Suaeda
shadscale saltbush	ATCO	Atriplex confertifolia
singleleaf ash	FRAN2	Fraxinus anomala
skunkbush sumac	RHTR	Rhus trilobata
snowberry	SYMPH	Symphoricarpos
spike dropseed	SPCO4	Sporobolus contractus
stickseed	LAPPU	Lappula sp

Table 8.—Index of Common Names, Plant Symbols, and Scientific Names—Continued

Local Common Name	Plant Symbol	Scientific Name
sumac	RHUS	Rhus
tamarisk	TAMAR2	Tamarix
tansymustard	DESCU	Descurainia
Torrey Mormon tea	EPTO	Ephedra torreyana
Torrey’s jointfir	EPTO	Ephedra torreyana
twoneedle pinyon	PIED	Pinus edulis
Utah juniper	JUOS	Juniperus osteosperma
Utah serviceberry	AMUT	Amelanchier utahensis
willow	SALIX	Salix
winterfat	KRLA2	Krascheninnikovia lanata

Table 9.--Land Management - Suitability for Planting and Soil Rutting Hazard

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil Rutting Hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
90:							
Arches--------------	65	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Sandiness	0.50	Sandiness	0.50		
				Slope	0.50		
91:							
Arches, sand sheet--	30	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
Mido----------------	30	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Slope	0.50	Low strength	0.50
				Sandiness	0.50		
92:							
Begay, bedrock substratum---------	50	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Mido----------------	40	Well suited		Well suited		Moderate	
						Low strength	0.50
93:							
Begay---------------	50	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Ignacio-------------	30	Well suited		Well suited		Moderate	
						Low strength	0.50
94:							
Bluechief-----------	45	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
Needle--------------	40	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Sandiness	0.50	Sandiness	0.50		
95:							
Goblin--------------	90	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Restrictive layer	1.00	Strength	0.10
		Sandiness	0.50	Slope	0.75		
		Rock fragments	0.50	Rock fragments	0.75		
				Sandiness	0.50		
96:							
Green River family--	75	Well suited		Well suited		Severe	
						Low strength	1.00

Table 9.--Land Management - Suitability for Planting and Soil Rutting Hazard--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil Rutting Hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Bebeevar------------	20	Well suited		Well suited		Moderate	
						Low strength	0.50
97:							
Mathis family-------	45	Unsuited		Unsuited		Slight	
		Rock fragments	1.00	Slope	1.00	Strength	0.10
		Slope	0.50	Rock fragments	1.00		
Rizno---------------	15	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Slope	0.75		
98:							
Mellenthin----------	50	Moderately suited		Poorly suited		Slight	
		Rock fragments	0.50	Rock fragments	0.75	Strength	0.10
Wayneco family------	35	Well suited		Moderately suited		Moderate	
				Rock fragments	0.50	Low strength	0.50
99:							
Mido family, occasionally flooded-----------	70	Well suited		Well suited		Moderate	
						Low strength	0.50
Green River family--	15	Well suited		Well suited		Severe	
						Low strength	1.00
100:							
Mido family, sodic--	70	Well suited		Well suited		Moderate	
						Low strength	0.50
101:							
Mido----------------	90	Well suited		Well suited		Moderate	
						Low strength	0.50
102:							
Mido----------------	95	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
103:							
Mido----------------	35	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
				Slope	0.50		
Batterson-----------	30	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Sandiness	0.50	Rock fragments	0.75		
		Rock fragments	0.50	Sandiness	0.50		
104:							
Mido----------------	65	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
Begay---------------	30	Well suited		Well suited		Severe	
						Low strength	1.00

Table 9.--Land Management - Suitability for Planting and Soil Rutting Hazard--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil Rutting Hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
105:							
Mido----------------	65	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
Mido family, frequently flooded-	15	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
106:							
Monue---------------	30	Well suited		Well suited		Moderate	
						Low strength	0.50
Trail---------------	30	Well suited		Well suited		Moderate	
						Low strength	0.50
Nepalto-------------	25	Moderately suited		Poorly suited		Moderate	
		Sandiness	0.50	Rock fragments	0.75	Low strength	0.50
		Rock fragments	0.50	Sandiness	0.50		
107:							
Pensom--------------	45	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Mido----------------	40	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Slope	0.50	Low strength	0.50
				Sandiness	0.50		
108:							
Reef----------------	60	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.75	Restrictive layer	1.00		
		Sandiness	0.50	Sandiness	0.50		
109:							
Reef----------------	65	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Slope	1.00	Low strength	0.50
		Rock fragments	0.75	Rock fragments	1.00		
		Slope	0.50	Restrictive layer	1.00		
110:							
Rizno---------------	50	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
				Slope	0.50		
Ignacio-------------	35	Well suited		Well suited		Moderate	
						Low strength	0.50
111:							
Rizno---------------	60	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
				Slope	0.50		
				Rock fragments	0.50		
112:							
Rizno---------------	40	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
				Slope	0.50		

Table 9.--Land Management - Suitability for Planting and Soil Rutting Hazard--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil Rutting Hazard: Rating class and limiting features	Value
113:							
Arches	25	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
114:							
Arches	15	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
				Slope	0.50		
115:							
Nalcase	25	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Sandiness	0.50	Sandiness	0.50		
116:							
Needle	35	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
		Sandiness	0.50	Sandiness	0.50		
117:							
Torriorthents	45	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Rock fragments	1.00	Low strength	0.50
		Restrictive layer	1.00	Slope	1.00		
				Restrictive layer	1.00		
118:							
Tsaya	45	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Restrictive layer	1.00		
		Slope	0.50	Rock fragments	0.75		
119:							
Sazi	50	Well suited		Well suited		Moderate	
						Low strength	0.50
Rizno	30	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Rock fragments	1.00	Low strength	0.50
		Rock fragments	0.75	Restrictive layer	1.00		
120:							
Sheppard family	30	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Tsaya family	30	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Restrictive layer	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Slope	0.50		
Bluechief family	20	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
121:							
Torriorthents	45	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Slope	1.00	Low strength	0.50
		Slope	0.50	Rock fragments	1.00		

Table 9.--Land Management - Suitability for Planting and Soil Rutting Hazard--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil Rutting Hazard: Rating class and limiting features	Value
122:							
Torriorthents	50	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Slope	1.00	Low strength	0.50
		Slope	0.50	Rock fragments	1.00		
123:							
Tsaya family	50	Poorly suited		Unsuited		Slight	
		Rock fragments	0.75	Rock fragments	1.00	Strength	0.10
Moenkopie	40	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Rock fragments	1.00	Low strength	0.50
		Restrictive layer	1.00	Restrictive layer	1.00		
124:							
Tsaya family	65	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Slope	1.00	Strength	0.10
		Rock fragments	0.75	Rock fragments	1.00		
		Slope	0.50	Restrictive layer	1.00		

Table 10.--Land Management - Hazard of Erosion and Suitability for Roads

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
90:							
Arches	65	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Sandiness	0.50
91:							
Arches, sand sheet	30	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Mido	30	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Sandiness	0.50
92:							
Begay, bedrock substratum	50	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Mido	40	Slight		Slight		Moderately suited	
						Sandiness	0.50
93:							
Begay	50	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Ignacio	30	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
94:							
Bluechief	45	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Needle	40	Slight		Slight		Moderately suited	
						Sandiness	0.50
95:							
Goblin	90	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Sandiness	0.50
96:							
Green River family	75	Slight		Slight		Poorly suited	
						Wetness	1.00
						Flooding	0.50
						Low strength	0.50
Bebeevar	20	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Wetness	0.50

Table 10.--Land Management - Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
97:							
Mathis family	45	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Rock fragments	1.00
						Slope	1.00
Rizno	15	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	0.50
98:							
Mellenthin	50	Slight		Slight		Well suited	
Wayneco family	35	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
99:							
Mido family, occasionally flooded	70	Slight		Slight		Moderately suited	
						Flooding	0.50
Green River family	15	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
						Wetness	0.50
100:							
Mido family, sodic	70	Slight		Slight		Well suited	
101:							
Mido	90	Slight		Slight		Well suited	
102:							
Mido	95	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
103:							
Mido	35	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Sandiness	0.50
Batterson	30	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Sandiness	0.50
104:							
Mido	65	Slight		Slight		Moderately suited	
						Sandiness	0.50
Begay	30	Slight		Slight		Moderately suited	
						Low strength	0.50
105:							
Mido	65	Slight		Slight		Moderately suited	
						Sandiness	0.50

Table 10.--Land Management - Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
105:							
Mido family, frequently flooded-	15	Slight		Slight		Poorly suited	
						Flooding	1.00
						Sandiness	0.50
106:							
Monue---------------	30	Slight		Slight		Well suited	
Trail---------------	30	Slight		Slight		Well suited	
Nepalto-------------	25	Slight		Slight		Moderately suited	
						Sandiness	0.50
107:							
Pensom--------------	45	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Mido----------------	40	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Sandiness	0.50
108:							
Reef----------------	60	Slight		Slight		Moderately suited	
						Sandiness	0.50
						Rock fragments	0.50
109:							
Reef----------------	65	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Rock fragments	1.00
						Slope	1.00
110:							
Rizno---------------	50	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Ignacio-------------	35	Slight		Slight		Well suited	
111:							
Rizno---------------	60	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
112:							
Rizno---------------	40	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
113:							
Arches--------------	25	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Sandiness	0.50
114:							
Arches--------------	15	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
115:							
Nalcase-------------	25	Slight		Slight		Moderately suited	
						Sandiness	0.50

Table 10.--Land Management - Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
116:							
Needle	35	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Sandiness	0.50
117:							
Torriorthents	45	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Rock fragments	1.00
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
118:							
Tsaya	45	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
119:							
Sazi	50	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Rizno	30	Slight		Slight		Moderately suited	
						Rock fragments	0.50
120:							
Sheppard family	30	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
Tsaya family	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	0.50
Bluechief family	20	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Rock fragments	0.50
121:							
Torriorthents	45	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Rock fragments	1.00
						Slope	1.00
122:							
Torriorthents	50	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
123:							
Tsaya family	50	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Rock fragments	0.50
Moenkopie	40	Slight		Slight		Poorly suited	
						Rock fragments	1.00
124:							
Tsaya family	65	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	0.50

Table 11.--Land Management - Site Preparation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (surface)		Suitability for mechanical site preparation (deep)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
90:					
Arches	65	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
91:					
Arches, sand sheet	30	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
Mido	30	Well suited		Well suited	
92:					
Begay, bedrock substratum	50	Well suited		Well suited	
Mido	40	Well suited		Well suited	
93:					
Begay	50	Well suited		Well suited	
Ignacio	30	Well suited		Poorly suited	
				Restrictive layer	0.50
94:					
Bluechief	45	Well suited		Poorly suited	
				Restrictive layer	0.50
Needle	40	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
95:					
Goblin	90	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
		Rock fragments	0.50		
96:					
Green River family	75	Well suited		Well suited	
Bebeevar	20	Well suited		Well suited	
97:					
Mathis family	45	Unsuited		Unsuited	
		Rock fragments	1.00	Slope	1.00
		Slope	1.00	Rock fragments	1.00

Table 11.--Land Management - Site Preparation--Continued

Map symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (surface): Rating class and limiting features	Value	Suitability for mechanical site preparation (deep): Rating class and limiting features	Value
97:					
Rizno	15	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50	Slope	0.50
		Slope	0.50		
98:					
Mellenthin	50	Poorly suited		Unsuited	
		Rock fragments	0.50	Restrictive layer	1.00
Wayneco family	35	Well suited		Unsuited	
				Restrictive layer	1.00
99:					
Mido family, occasionally flooded	70	Well suited		Well suited	
Green River family	15	Well suited		Well suited	
100:					
Mido family, sodic	70	Well suited		Well suited	
101:					
Mido	90	Well suited		Well suited	
102:					
Mido	95	Well suited		Well suited	
103:					
Mido	35	Well suited		Well suited	
Batterson	30	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50		
104:					
Mido	65	Well suited		Well suited	
Begay	30	Well suited		Well suited	
105:					
Mido	65	Well suited		Well suited	
Mido family, frequently flooded	15	Well suited		Well suited	
106:					
Monue	30	Well suited		Well suited	
Trail	30	Well suited		Well suited	
Nepalto	25	Poorly suited		Well suited	
		Rock fragments	0.50		
107:					
Pensom	45	Well suited		Well suited	
Mido	40	Well suited		Well suited	

Table 11.--Land Management - Site Preparation--Continued

Map symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (surface)		Suitability for mechanical site preparation (deep)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
108:					
Reef	60	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50		
109:					
Reef	65	Unsuited		Unsuited	
		Rock fragments	1.00	Slope	1.00
		Slope	1.00	Rock fragments	1.00
		Restrictive layer	1.00	Restrictive layer	1.00
110:					
Rizno	50	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
Ignacio	35	Well suited		Poorly suited	
				Restrictive layer	0.50
111:					
Rizno	60	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
112:					
Rizno	40	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
113:					
Arches	25	Well suited		Unsuited	
				Restrictive layer	1.00
114:					
Arches	15	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
115:					
Nalcase	25	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
116:					
Needle	35	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
117:					
Torriorthents	45	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Restrictive layer	1.00	Restrictive layer	1.00
		Slope	0.50	Slope	0.50
118:					
Tsaya	45	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50		
119:					
Sazi	50	Well suited		Poorly suited	
				Restrictive layer	0.50

Table 11.--Land Management - Site Preparation--Continued

Map symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (surface)		Suitability for mechanical site preparation (deep)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
119:					
Rizno	30	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50		
120:					
Sheppard family	30	Well suited		Poorly suited	
				Restrictive layer	0.50
Tsaya family	30	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
		Rock fragments	0.50	Rock fragments	0.50
		Slope	0.50	Slope	0.50
Bluechief family	20	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
				Restrictive layer	0.50
121:					
Torriorthents	45	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
		Rock fragments	1.00	Rock fragments	1.00
				Restrictive layer	0.50
122:					
Torriorthents	50	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
		Rock fragments	1.00	Rock fragments	1.00
				Restrictive layer	0.50
123:					
Tsaya family	50	Poorly suited		Unsuited	
		Rock fragments	0.50	Restrictive layer	1.00
Moenkopie	40	Unsuited		Unsuited	
		Rock fragments	1.00	Restrictive layer	1.00
		Restrictive layer	1.00		
124:					
Tsaya family	65	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Rock fragments	1.00
		Rock fragments	0.50	Restrictive layer	1.00

Table 12.--Land Management - Damage by Fire and Seedling Mortality

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
90:					
Arches	65	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
91:					
Arches, sand sheet	30	High		High	
		Texture/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Mido	30	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
92:					
Begay, bedrock substratum	50	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
Mido	40	High		High	
		Texture/rock fragments	1.00	Available water	1.00
93:					
Begay	50	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
Ignacio	30	Moderate		Moderate	
		Texture/rock fragments	0.50	Available water	0.50
94:					
Bluechief	45	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
94:					
Needle	40	High		High	
		Texture/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
95:					
Goblin	90	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
				Salinity	0.50
96:					
Green River family	75	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Wetness	1.00
				Available water	0.50
				Carbonate content	0.50
				Soil reaction	0.50
Bebeevar	20	High		High	
		Texture/surface depth/rock fragments	1.00	Wetness	1.00
				Available water	1.00
				Soil reaction	0.50
97:					
Mathis family	45	High		Moderate	
		Texture/slope/rock fragments	1.00	Soil reaction	0.50
				Available water	0.50
Rizno	15	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
98:					
Mellenthin	50	High		High	
		Texture/rock fragments	1.00	Available water	1.00
				Carbonate content	0.50
				Soil reaction	0.50
Wayneco family	35	High		High	
		Texture/surface depth/rock fragments	1.00	Carbonate content	1.00
				Available water	1.00
				Soil reaction	0.50

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
99:					
Mido family, occasionally flooded-----------	70	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Green River family--	15	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
100:					
Mido family, sodic--	70	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
				Salinity	0.50
101:					
Mido----------------	90	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
102:					
Mido----------------	95	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
103:					
Mido----------------	35	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Batterson-----------	30	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Carbonate content	0.50
				Soil reaction	0.50
104:					
Mido----------------	65	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
104:					
Begay	30	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Available water	0.50
				Soil reaction	0.50
105:					
Mido	65	High		High	
		Texture/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Mido family, frequently flooded	15	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
106:					
Monue	30	High		Moderate	
		Texture/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
				Salinity	0.50
Trail	30	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Nepalto	25	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
107:					
Pensom	45	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Mido	40	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
108:					
Reef	60	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
109:					
Reef	65	High		Moderate	
		Texture/slope/surface depth/rock fragments	1.00	Soil reaction	0.50
				Available water	0.50
110:					
Rizno	50	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Ignacio	35	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
111:					
Rizno	60	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Available water	1.00
				Soil reaction	0.50
112:					
Rizno	40	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Available water	1.00
				Soil reaction	0.50
113:					
Arches	25	High		High	
		Texture/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
114:					
Arches	15	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
115:					
Nalcase	25	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
116:					
Needle	35	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
117:					
Torriorthents	45	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
118:					
Tsaya	45	High		Moderate	
		Texture/slope/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
119:					
Sazi	50	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Available water	0.50
				Carbonate content	0.50
				Soil reaction	0.50
Rizno	30	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
120:					
Sheppard family	30	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Soil reaction	0.50
Tsaya family	30	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
Bluechief family	20	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Available water	1.00
				Soil reaction	0.50

Table 12.--Land Management - Damage by Fire and Seedling Mortality--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
121:					
Torriorthents-------	45	High		Moderate	
		Texture/slope/surface depth/rock fragments	1.00	Available water	0.50
				Soil reaction	0.50
122:					
Torriorthents-------	50	Moderate		Moderate	
		Texture/slope/rock fragments	0.50	Carbonate content	0.50
				Soil reaction	0.50
123:					
Tsaya family--------	50	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
Moenkopie-----------	40	High		High	
		Texture/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50
124:					
Tsaya family--------	65	High		High	
		Texture/slope/surface depth/rock fragments	1.00	Available water	1.00
				Soil reaction	0.50

Table 13.--Camp and Picnic Areas

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
90:					
Arches	65	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
91:					
Arches, sand sheet	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.98	Too sandy	0.98
Mido	30	Somewhat limited		Somewhat limited	
		Too sandy	0.99	Too sandy	0.99
		Slope	0.01	Slope	0.01
92:					
Begay, bedrock substratum	50	Somewhat limited		Somewhat limited	
		Too sandy	0.24	Too sandy	0.24
Mido	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
93:					
Begay	50	Somewhat limited		Somewhat limited	
		Too sandy	0.88	Too sandy	0.88
Ignacio	30	Somewhat limited		Somewhat limited	
		Too sandy	0.01	Too sandy	0.01
94:					
Bluechief	45	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Needle	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
95:					
Goblin	90	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too steep	1.00	Too steep	1.00
		Large stones content	0.76	Large stones content	0.76
		Too sandy	0.32	Too sandy	0.32

Table 13.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
96:					
Green River family--	75	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	1.00	Dusty	0.50
		Dusty	0.50		
Bebeevar------------	20	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Too sandy	0.98
		Flooding	1.00	Depth to saturated zone	0.90
		Too sandy	0.98		
97:					
Mathis family-------	45	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
		Too sandy	0.92	Too sandy	0.92
Rizno---------------	15	Very limited		Very limited	
		Too steep	1.00	Too sandy	1.00
		Too sandy	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
98:					
Mellenthin----------	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too sandy	0.59	Too sandy	0.59
Wayneco family------	35	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.95	Gravel	0.95
		Too sandy	0.76	Too sandy	0.76
99:					
Mido family, occasionally flooded------------	70	Very limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.98
		Too sandy	0.98		
Green River family--	15	Very limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.98
		Too sandy	0.98	Flooding	0.40
		Depth to saturated zone	0.72	Depth to saturated zone	0.39
100:					
Mido family, sodic--	70	Very limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.99
		Too sandy	0.99		

Table 13.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
101:					
Mido----------------	90	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
102:					
Mido----------------	95	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
103:					
Mido----------------	35	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Batterson-----------	30	Very limited		Very limited	
		Depth to bedrock	1.00	Too sandy	1.00
		Too sandy	1.00	Depth to bedrock	1.00
104:					
Mido----------------	65	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Begay---------------	30	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Dusty	0.50	Dusty	0.50
105:					
Mido----------------	65	Very limited		Very limited	
		Flooding	1.00	Too sandy	1.00
		Too sandy	1.00		
Mido family, frequently flooded-	15	Very limited		Very limited	
		Flooding	1.00	Too sandy	1.00
		Too sandy	1.00	Flooding	0.40
106:					
Monue---------------	30	Very limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.92
		Too sandy	0.92	Salinity	0.01
		Salinity	0.01		
Trail---------------	30	Very limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.82
		Too sandy	0.82		
Nepalto-------------	25	Very limited		Very limited	
		Flooding	1.00	Too sandy	1.00
		Too sandy	1.00		
107:					
Pensom--------------	45	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Slope	0.01	Slope	0.01
Mido----------------	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00

Table 13.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
108:					
Reef----------------	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too sandy	0.32	Too sandy	0.32
109:					
Reef----------------	65	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
		Gravel	0.08	Gravel	0.08
110:					
Rizno---------------	50	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
Ignacio-------------	35	Not limited		Not limited	
111:					
Rizno---------------	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.20	Gravel	0.20
		Too sandy	0.12	Too sandy	0.12
112:					
Rizno---------------	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.04	Too sandy	0.04
113:					
Arches--------------	25	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
114:					
Arches--------------	15	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.76	Too sandy	0.76
		Slope	0.63	Slope	0.63
115:					
Nalcase-------------	25	Very limited		Very limited	
		Depth to bedrock	1.00	Too sandy	1.00
		Too sandy	1.00	Depth to bedrock	1.00
116:					
Needle--------------	35	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00

Table 13.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
117:					
Torriorthents-------	45	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
118:					
Tsaya---------------	45	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Dusty	0.50	Dusty	0.50
119:					
Sazi----------------	50	Somewhat limited		Somewhat limited	
		Too sandy	0.12	Too sandy	0.12
Rizno---------------	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.92	Too sandy	0.92
		Gravel	0.01	Gravel	0.01
120:					
Sheppard family-----	30	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Tsaya family--------	30	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.12	Too sandy	0.12
Bluechief family----	20	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Gravel	0.54	Gravel	0.54
121:					
Torriorthents-------	45	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
		Gravel	0.98	Gravel	0.98
122:					
Torriorthents-------	50	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	1.00	Large stones content	1.00
		Too sandy	0.04	Too sandy	0.04

Table 13.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
123:					
Tsaya family--------	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00
		Too sandy	0.18	Too sandy	0.18
Moenkopie-----------	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.68	Too sandy	0.68
124:					
Tsaya family--------	65	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	1.00	Gravel	1.00

Table 14.--Trail Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
90:					
Arches------------------	65	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
91:					
Arches, sand sheet------	30	Somewhat limited		Somewhat limited	
		Too sandy	0.98	Too sandy	0.98
Mido--------------------	30	Somewhat limited		Somewhat limited	
		Too sandy	0.99	Too sandy	0.99
92:					
Begay, bedrock substratum-------------	50	Somewhat limited		Somewhat limited	
		Too sandy	0.24	Too sandy	0.24
Mido--------------------	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
93:					
Begay-------------------	50	Somewhat limited		Somewhat limited	
		Too sandy	0.88	Too sandy	0.88
Ignacio-----------------	30	Somewhat limited		Somewhat limited	
		Too sandy	0.01	Too sandy	0.01
94:					
Bluechief---------------	45	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Needle------------------	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
95:					
Goblin------------------	90	Somewhat limited		Somewhat limited	
		Large stones content	0.76	Large stones content	0.76
		Slope	0.50	Too sandy	0.32
		Too sandy	0.32		
96:					
Green River family------	75	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Dusty	0.50	Dusty	0.50
Bebeevar----------------	20	Somewhat limited		Somewhat limited	
		Too sandy	0.98	Too sandy	0.98
		Depth to saturated zone	0.78	Depth to saturated zone	0.78

Table 14.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
97:					
Mathis family	45	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	1.00
		Too sandy	0.92	Too sandy	0.92
Rizno	15	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Slope	0.82		
98:					
Mellenthin	50	Somewhat limited		Somewhat limited	
		Too sandy	0.59	Too sandy	0.59
Wayneco family	35	Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76
99:					
Mido family, occasionally flooded	70	Somewhat limited		Somewhat limited	
		Too sandy	0.98	Too sandy	0.98
Green River family	15	Somewhat limited		Somewhat limited	
		Too sandy	0.98	Too sandy	0.98
		Flooding	0.40	Flooding	0.40
		Depth to saturated zone	0.06	Depth to saturated zone	0.06
100:					
Mido family, sodic	70	Somewhat limited		Somewhat limited	
		Too sandy	0.99	Too sandy	0.99
101:					
Mido	90	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
102:					
Mido	95	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
103:					
Mido	35	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Batterson	30	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
104:					
Mido	65	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Begay	30	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Dusty	0.50	Dusty	0.50

Table 14.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
105:					
Mido-------------------	65	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Mido family, frequently flooded----------------	15	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
		Flooding	0.40	Flooding	0.40
106:					
Monue------------------	30	Somewhat limited		Somewhat limited	
		Too sandy	0.92	Too sandy	0.92
Trail------------------	30	Somewhat limited		Somewhat limited	
		Too sandy	0.82	Too sandy	0.82
Nepalto----------------	25	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
107:					
Pensom-----------------	45	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Mido-------------------	40	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
108:					
Reef-------------------	60	Somewhat limited		Somewhat limited	
		Too sandy	0.32	Too sandy	0.32
109:					
Reef-------------------	65	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
110:					
Rizno------------------	50	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Ignacio----------------	35	Not limited		Not limited	
111:					
Rizno------------------	60	Somewhat limited		Somewhat limited	
		Too sandy	0.12	Too sandy	0.12
112:					
Rizno------------------	40	Somewhat limited		Somewhat limited	
		Too sandy	0.04	Too sandy	0.04
113:					
Arches-----------------	25	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
114:					
Arches-----------------	15	Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76

Table 14.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
115:					
Nalcase	25	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
116:					
Needle	35	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
117:					
Torriorthents	45	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	0.08
118:					
Tsaya	45	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
119:					
Sazi	50	Somewhat limited		Somewhat limited	
		Too sandy	0.12	Too sandy	0.12
Rizno	30	Somewhat limited		Somewhat limited	
		Too sandy	0.92	Too sandy	0.92
120:					
Sheppard family	30	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
Tsaya family	30	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Too sandy	0.12	Too sandy	0.12
Bluechief family	20	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
121:					
Torriorthents	45	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	1.00
122:					
Torriorthents	50	Very limited		Very limited	
		Slope	1.00	Large stones content	1.00
		Large stones content	1.00	Slope	0.99
		Too sandy	0.04	Too sandy	0.04
123:					
Tsaya family	50	Somewhat limited		Somewhat limited	
		Too sandy	0.18	Too sandy	0.18
Moenkopie	40	Somewhat limited		Somewhat limited	
		Too sandy	0.68	Too sandy	0.68
124:					
Tsaya family	65	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	1.00

Table 15.--Dwellings and Small Commercial Buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
90:							
Arches	65	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00	Slope	1.00
91:							
Arches, sand sheet	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
Mido	30	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
92:							
Begay, bedrock substratum	50	Not limited		Not limited		Somewhat limited	
						Slope	0.12
Mido	40	Not limited		Not limited		Not limited	
93:							
Begay	50	Not limited		Not limited		Somewhat limited	
						Slope	0.12
Ignacio	30	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.97	Depth to hard bedrock	1.00	Depth to hard bedrock	0.97
94:							
Bluechief	45	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.13	Depth to hard bedrock	1.00	Depth to hard bedrock	0.13
						Slope	0.12
Needle	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
95:							
Goblin	90	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00	Slope	1.00

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
96:							
Green River family--	75	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Bebeevar------------	20	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
97:							
Mathis family-------	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Large stones	1.00	Large stones	1.00	Large stones	1.00
Rizno---------------	15	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
98:							
Mellenthin----------	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Wayneco family------	35	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
99:							
Mido family, occasionally flooded------------	70	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Green River family--	15	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.72	Depth to saturated zone	1.00	Depth to saturated zone	0.72
100:							
Mido family, sodic--	70	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
101:							
Mido----------------	90	Not limited		Not limited		Not limited	
102:							
Mido----------------	95	Not limited		Not limited		Somewhat limited	
						Slope	0.88
103:							
Mido----------------	35	Not limited		Not limited		Somewhat limited	
						Slope	0.50

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
103:							
Batterson	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
104:							
Mido	65	Not limited		Not limited		Not limited	
Begay	30	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
105:							
Mido	65	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Mido family, frequently flooded	15	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
106:							
Monue	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Trail	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Nepalto	25	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
107:							
Pensom	45	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Depth to hard bedrock	0.98	Slope	1.00
				Slope	0.01		
Mido	40	Not limited		Not limited		Somewhat limited	
						Slope	0.50
108:							
Reef	60	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
109:							
Reef	65	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.08	Large stones	0.08	Large stones	0.08
110:							
Rizno	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.50

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
110:							
Ignacio-------------	35	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.96	Depth to hard bedrock	1.00	Depth to hard bedrock	0.96
111:							
Rizno---------------	60	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
						Slope	0.88
112:							
Rizno---------------	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.12
113:							
Arches--------------	25	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
114:							
Arches--------------	15	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.63	Slope	0.63	Slope	1.00
115:							
Nalcase-------------	25	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
116:							
Needle--------------	35	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
117:							
Torriorthents-------	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
118:							
Tsaya---------------	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
119:							
Sazi----------------	50	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.50	Depth to hard bedrock	1.00	Depth to hard bedrock	0.50
				Depth to soft bedrock	0.68		
Rizno---------------	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
120:							
Sheppard family-----	30	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.50	Depth to hard bedrock	1.00	Depth to hard bedrock	0.50
						Slope	0.12
Tsaya family--------	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00	Slope	1.00
Bluechief family----	20	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.97	Depth to hard bedrock	1.00	Depth to hard bedrock	0.97
						Slope	0.12
121:							
Torriorthents-------	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Depth to hard bedrock	0.74	Too steep	1.00	Depth to hard bedrock	0.74
		Large stones	0.72	Large stones	0.72	Large stones	0.72
122:							
Torriorthents-------	50	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	0.20	Depth to hard bedrock	1.00	Depth to hard bedrock	0.20
123:							
Tsaya family--------	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Moenkopie-----------	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
124:							
Tsaya family--------	65	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00

Table 16.--Roads and Streets, Shallow Excavations

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Local roads and streets: Value	Shallow excavations: Rating class and limiting features	Shallow excavations: Value
90:					
Arches	65	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
91:					
Arches, sand sheet	30	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
Mido	30	Somewhat limited		Very limited	
		Slope	0.01	Unstable excavation walls	1.00
				Slope	0.01
92:					
Begay, bedrock substratum	50	Somewhat limited		Somewhat limited	
		Frost action	0.50	Unstable excavation walls	0.10
Mido	40	Not limited		Very limited	
				Unstable excavation walls	1.00
93:					
Begay	50	Somewhat limited		Somewhat limited	
		Frost action	0.50	Unstable excavation walls	0.10
Ignacio	30	Somewhat limited		Very limited	
		Depth to hard bedrock	0.97	Depth to hard bedrock	1.00
		Frost action	0.50	Unstable excavation walls	0.10
94:					
Bluechief	45	Somewhat limited		Very limited	
		Frost action	0.50	Depth to hard bedrock	1.00
		Depth to hard bedrock	0.13	Unstable excavation walls	1.00

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Needle--------------	40	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
95:					
Goblin--------------	90	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Frost action	0.50		
96:					
Green River family--	75	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	1.00	Unstable excavation walls	1.00
				Flooding	0.60
Bebeevar------------	20	Somewhat limited		Very limited	
		Depth to saturated zone	0.90	Depth to saturated zone	1.00
		Flooding	0.40	Unstable excavation walls	1.00
97:					
Mathis family-------	45	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones	1.00	Unstable excavation walls	1.00
				Large stones	1.00
Rizno---------------	15	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
98:					
Mellenthin----------	50	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Frost action	0.50	Unstable excavation walls	0.10
Wayneco family------	35	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Frost action	0.50		

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value
99:					
Mido family, occasionally flooded	70	Very limited		Very limited	
		Flooding	1.00	Unstable excavation walls	1.00
				Flooding	0.60
Green River family	15	Very limited		Very limited	
		Flooding	1.00	Depth to saturated zone	1.00
		Depth to saturated zone	0.39	Unstable excavation walls	1.00
				Flooding	0.80
100:					
Mido family, sodic	70	Somewhat limited		Very limited	
		Flooding	0.20	Unstable excavation walls	1.00
101:					
Mido	90	Not limited		Very limited	
				Unstable excavation walls	1.00
102:					
Mido	95	Not limited		Very limited	
				Unstable excavation walls	1.00
103:					
Mido	35	Not limited		Very limited	
				Unstable excavation walls	1.00
Batterson	30	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
104:					
Mido	65	Not limited		Very limited	
				Unstable excavation walls	1.00
Begay	30	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
				Unstable excavation walls	1.00
105:					
Mido	65	Somewhat limited		Very limited	
		Flooding	0.40	Unstable excavation walls	1.00

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mido family, frequently flooded-	15	Very limited		Very limited	
		Flooding	1.00	Unstable excavation walls	1.00
				Flooding	0.80
106:					
Monue---------------	30	Somewhat limited		Very limited	
		Frost action	0.50	Unstable excavation walls	1.00
		Flooding	0.40		
Trail---------------	30	Somewhat limited		Very limited	
		Flooding	0.40	Unstable excavation walls	1.00
Nepalto-------------	25	Somewhat limited		Very limited	
		Flooding	0.20	Unstable excavation walls	1.00
107:					
Pensom--------------	45	Somewhat limited		Very limited	
		Slope	0.01	Unstable excavation walls	1.00
				Depth to hard bedrock	0.98
				Slope	0.01
Mido----------------	40	Not limited		Very limited	
				Unstable excavation walls	1.00
108:					
Reef----------------	60	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Frost action	0.50		
109:					
Reef----------------	65	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Frost action	0.50	Large stones	0.08
		Large stones	0.08		
110:					
Rizno---------------	50	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Frost action	0.50		

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Ignacio	35	Somewhat limited		Very limited	
		Depth to hard bedrock	0.96	Depth to hard bedrock	1.00
		Frost action	0.50	Unstable excavation walls	0.10
111:					
Rizno	60	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
112:					
Rizno	40	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Frost action	0.50		
113:					
Arches	25	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
				Unstable excavation walls	0.10
114:					
Arches	15	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.63	Slope	0.63
115:					
Nalcase	25	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
116:					
Needle	35	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
				Unstable excavation walls	0.10
117:					
Torriorthents	45	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Frost action	0.50		

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value
118:					
Tsaya---------------	45	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	1.00	Too steep	1.00
119:					
Sazi----------------	50	Somewhat limited		Very limited	
		Frost action	0.50	Depth to hard bedrock	1.00
		Depth to hard bedrock	0.50	Depth to soft bedrock	0.68
				Unstable excavation walls	0.10
Rizno---------------	30	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
				Unstable excavation walls	0.10
120:					
Sheppard family-----	30	Somewhat limited		Very limited	
		Depth to hard bedrock	0.50	Depth to hard bedrock	1.00
				Unstable excavation walls	1.00
Tsaya family--------	30	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	0.10
Bluechief family----	20	Somewhat limited		Very limited	
		Depth to hard bedrock	0.97	Depth to hard bedrock	1.00
		Frost action	0.50	Unstable excavation walls	0.10
121:					
Torriorthents-------	45	Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00
		Depth to hard bedrock	0.74	Too steep	1.00
		Large stones	0.72	Large stones	0.72
		Frost action	0.50	Unstable excavation walls	0.10

Table 16.--Roads and Streets, Shallow Excavations--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value
122:					
Torriorthents-------	50	Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00
		Depth to hard bedrock	0.20	Too steep	1.00
				Unstable excavation walls	1.00
123:					
Tsaya family--------	50	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Frost action	0.50	Unstable excavation walls	0.10
Moenkopie-----------	40	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Frost action	0.50		
124:					
Tsaya family--------	65	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.10

Table 17.--Sewage Disposal

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
90:					
Arches	65	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
91:					
Arches, sand sheet	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Slope	0.08
Mido	30	Somewhat limited		Very limited	
		Depth to bedrock	0.25	Seepage	1.00
		Slope	0.01	Slope	1.00
92:					
Begay, bedrock substratum	50	Somewhat limited		Very limited	
		Depth to bedrock	0.22	Seepage	1.00
				Slope	0.68
Mido	40	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.08
93:					
Begay	50	Not limited		Very limited	
				Seepage	1.00
				Slope	0.68
Ignacio	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.08
94:					
Bluechief	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.68

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
94:					
Needle	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.32
95:					
Goblin	90	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
96:					
Green River family	75	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Filtering capacity	1.00	Seepage	1.00
Bebeevar	20	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slow water movement	0.50	Seepage	1.00
		Flooding	0.40	Flooding	0.40
				Slope	0.08
97:					
Mathis family	45	Very limited		Very limited	
		Filtering capacity	1.00	Slope	1.00
		Too steep	1.00	Large stones	1.00
		Large stones	1.00	Seepage	1.00
Rizno	15	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
98:					
Mellenthin	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.32
Wayneco family	35	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Seepage	1.00
				Slope	0.08

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
99:					
Mido family, occasionally flooded	70	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
Green River family	15	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Seepage	1.00
		Filtering capacity	1.00	Depth to saturated zone	1.00
100:					
Mido family, sodic	70	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.20	Flooding	0.20
101:					
Mido	90	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
102:					
Mido	95	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	1.00
103:					
Mido	35	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.92
Batterson	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Slope	0.08
104:					
Mido	65	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.08
Begay	30	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
				Seepage	1.00

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
105:					
Mido	65	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
				Slope	0.08
Mido family, frequently flooded	15	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.08
106:					
Monue	30	Somewhat limited		Very limited	
		Flooding	0.40	Seepage	1.00
				Flooding	0.40
Trail	30	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
Nepalto	25	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.20	Flooding	0.20
				Slope	0.08
107:					
Pensom	45	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Depth to bedrock	0.99	Slope	1.00
		Slope	0.01	Depth to hard bedrock	0.98
Mido	40	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.92
108:					
Reef	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Slope	0.32
109:					
Reef	65	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.08	Seepage	0.68

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
110:					
Rizno	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.92
Ignacio	35	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
111:					
Rizno	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Slope	1.00
112:					
Rizno	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.68
113:					
Arches	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.32
114:					
Arches	15	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.63	Slope	1.00
115:					
Nalcase	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Slope	0.08
116:					
Needle	35	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.32
117:					
Torriorthents	45	Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
118:					
Tsaya	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Depth to soft bedrock	1.00
				Slope	1.00
119:					
Sazi	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	1.00
				Seepage	1.00
				Slope	0.32
Rizno	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
120:					
Sheppard family	30	Very limited		Very limited	
		Filtering capacity	1.00	Depth to hard bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00
				Slope	0.68
Tsaya family	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.28
Bluechief family	20	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.68
121:					
Torriorthents	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Seepage	1.00
		Large stones	0.72	Slope	1.00
				Large stones	1.00
122:					
Torriorthents	50	Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
				Seepage	1.00

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
123:					
Tsaya family--------	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	1.00
				Slope	0.32
Moenkopie-----------	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.08
124:					
Tsaya family--------	65	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00

Table 18.--Source of Gravel and Sand

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
90:					
Arches	65	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.27
91:					
Arches, sand sheet	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
Mido	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.27
		Thickest layer	0.00	Bottom layer	0.68
92:					
Begay, bedrock substratum	50	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.04
		Thickest layer	0.00	Thickest layer	0.04
Mido	40	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.03
93:					
Begay	50	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.03
		Thickest layer	0.00	Bottom layer	0.04
Ignacio	30	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.03
94:					
Bluechief	45	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.02
Needle	40	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.35

Table 18.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel: Rating class	Value	Potential source of sand: Rating class	Value
95:					
Goblin	90	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.62	Bottom layer	0.07
96:					
Green River family	75	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Bebeevar	20	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.07
97:					
Mathis family	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rizno	15	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.03
98:					
Mellenthin	50	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.05	Bottom layer	0.05
Wayneco family	35	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
99:					
Mido family, occasionally flooded	70	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.14
		Thickest layer	0.00	Thickest layer	0.14
Green River family	15	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.12
100:					
Mido family, sodic	70	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.13
		Thickest layer	0.00	Bottom layer	0.16
101:					
Mido	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.18

Table 18.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
102:					
Mido----------------	95	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.13
		Thickest layer	0.00	Thickest layer	0.23
103:					
Mido----------------	35	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.35
		Thickest layer	0.00	Thickest layer	0.35
Batterson-----------	30	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.00	Bottom layer	0.70
104:					
Mido----------------	65	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.27
		Thickest layer	0.00	Bottom layer	0.30
Begay---------------	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
105:					
Mido----------------	65	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.35
		Bottom layer	0.00	Bottom layer	0.89
Mido family, frequently flooded-	15	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.71
		Thickest layer	0.00	Bottom layer	0.95
106:					
Monue---------------	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.68
Trail---------------	30	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.04
		Thickest layer	0.00	Thickest layer	0.06
Nepalto-------------	25	Fair		Fair	
		Bottom layer	0.12	Bottom layer	0.31
		Thickest layer	0.12	Thickest layer	0.38
107:					
Pensom--------------	45	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.14
Mido----------------	40	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.30
		Thickest layer	0.00	Bottom layer	0.40

Table 18.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
108:					
Reef	60	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.00	Bottom layer	0.10
109:					
Reef	65	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
110:					
Rizno	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Ignacio	35	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.02
		Thickest layer	0.00	Thickest layer	0.02
111:					
Rizno	60	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
112:					
Rizno	40	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.06
113:					
Arches	25	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.16
114:					
Arches	15	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
115:					
Nalcase	25	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.27
116:					
Needle	35	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.20

Table 18.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
117:					
Torriorthents-------	45	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
118:					
Tsaya---------------	45	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
119:					
Sazi----------------	50	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.07
		Thickest layer	0.00	Thickest layer	0.07
Rizno---------------	30	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.07
120:					
Sheppard family-----	30	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.05
		Thickest layer	0.00	Thickest layer	0.06
Tsaya family--------	30	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.28	Bottom layer	0.04
Bluechief family----	20	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.07
		Thickest layer	0.00	Thickest layer	0.07
121:					
Torriorthents-------	45	Poor		Fair	
		Thickest layer	0.00	Bottom layer	0.07
		Bottom layer	0.00	Thickest layer	0.07
122:					
Torriorthents-------	50	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00

Table 18.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
123:					
Tsaya family	50	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.28	Bottom layer	0.05
Moenkopie	40	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.00	Bottom layer	0.06
124:					
Tsaya family	65	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.18	Bottom layer	0.09

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
90:							
Arches--------------	65	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00			Slope	0.00
		Depth to bedrock	0.00				
		Organic matter content low	0.50				
91:							
Arches, sand sheet--	30	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00				
		Depth to bedrock	0.00				
Mido----------------	30	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Droughty	0.10				
92:							
Begay, bedrock substratum---------	50	Poor		Good		Fair	
		Organic matter content low	0.00			Rock fragments	0.92
		Water erosion	0.90			Too sandy	0.96
		Too sandy	0.96				
Mido----------------	40	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.20
		Organic matter content low	0.00				
		Too sandy	0.20				
93:							
Begay---------------	50	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.78
		Organic matter content low	0.50				
		Too sandy	0.78				
Ignacio-------------	30	Poor		Poor		Fair	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.03
		Depth to bedrock	0.03			Too sandy	0.92
		Organic matter content low	0.50				
		Too sandy	0.92				

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
94:							
Bluechief	45	Poor		Poor		Fair	
		Wind erosion	0.00	Depth to bedrock	0.00	Rock fragments	0.04
		Organic matter content low	0.00			Depth to bedrock	0.86
		Carbonate content	0.46			Carbonate content	0.92
		Droughty	0.52				
		Depth to bedrock	0.86				
Needle	40	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Too sandy	0.00
		Depth to bedrock	0.00				
		Too sandy	0.00				
		Organic matter content low	0.50				
95:							
Goblin	90	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.50	Depth to bedrock	0.00
		Organic matter content low	0.50			Slope	0.00
		Too sandy	0.78			Too sandy	0.78
96:							
Green River family	75	Poor		Poor		Poor	
		Too alkaline	0.00	Wetness depth	0.00	Wetness depth	0.00
		Too sandy	0.08			Too sandy	0.08
		Organic matter content low	0.50				
		Water erosion	0.68				
		Carbonate content	0.92				
Bebeevar	20	Poor		Fair		Poor	
		Wind erosion	0.00	Wetness depth	0.06	Too sandy	0.00
		Too sandy	0.00			Wetness depth	0.06
		Organic matter content low	0.50				
97:							
Mathis family	45	Poor		Poor		Poor	
		Too sandy	0.00	Slope	0.00	Slope	0.00
		Stone content	0.00	Stones	0.00	Too sandy	0.00
		Organic matter content low	0.00	Cobble content	0.93	Rock fragments	0.19
		Droughty	0.00			Hard to reclaim (rock fragments)	0.32
Rizno	15	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Slope	0.00
		Droughty	0.00	Slope	0.18	Depth to bedrock	0.00
		Depth to bedrock	0.00			Rock fragments	0.24
		Organic matter content low	0.00			Too sandy	0.68
		Too sandy	0.68				

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
98:							
Mellenthin----------	50	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Droughty	0.00			Depth to bedrock	0.00
		Depth to bedrock	0.00			Too sandy	0.96
		Organic matter content low	0.50			Carbonate content	0.98
		Carbonate content	0.92				
		Too sandy	0.96				
Wayneco family------	35	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Carbonate content	0.35
		Depth to bedrock	0.00			Rock fragments	0.99
		Carbonate content	0.00				
		Organic matter content low	0.50				
99:							
Mido family, occasionally flooded------------	70	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Water erosion	0.68				
		Droughty	0.68				
Green River family--	15	Poor		Fair		Poor	
		Too sandy	0.00	Wetness depth	0.35	Too sandy	0.00
		Wind erosion	0.00			Wetness depth	0.35
		Organic matter content low	0.00				
		Water erosion	0.68				
100:							
Mido family, sodic--	70	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Salinity	0.50
		Organic matter content low	0.00				
		Too alkaline	0.00				
		Droughty	0.82				
101:							
Mido----------------	90	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
102:							
Mido----------------	95	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Too alkaline	0.00				
		Droughty	0.68				
103:							
Mido----------------	35	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Droughty	0.39				
		Organic matter content low	0.50				
Batterson-----------	30	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00				
		Depth to bedrock	0.00				
		Carbonate content	0.97				
104:							
Mido----------------	65	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Too alkaline	0.00				
		Droughty	0.68				
Begay---------------	30	Fair		Good		Good	
		Organic matter content low	0.50				
		Water erosion	0.68				
105:							
Mido----------------	65	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Droughty	0.05				
		Organic matter content low	0.50				
Mido family, frequently flooded-	15	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Droughty	0.39				

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
106:							
Monue	30	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Water erosion	0.37				
		Carbonate content	0.99				
Trail	30	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Droughty	0.97				
Nepalto	25	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Rock fragments	0.00
		Droughty	0.00			Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.00				
107:							
Pensom	45	Poor		Fair		Poor	
		Too sandy	0.00	Depth to bedrock	0.02	Too sandy	0.00
		Wind erosion	0.00				
		Droughty	0.00				
		Organic matter content low	0.00				
Mido	40	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
		Droughty	0.68				
108:							
Reef	60	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
		Too sandy	0.44			Too sandy	0.44
109:							
Reef	65	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Slope	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
		Cobble content	0.92			Rock fragments	0.00

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
110:							
Rizno	50	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Too sandy	0.86
		Depth to bedrock	0.00				
		Water erosion	0.37				
		Organic matter content low	0.50				
		Too sandy	0.86				
Ignacio	35	Poor		Poor		Fair	
		Too alkaline	0.00	Depth to bedrock	0.00	Depth to bedrock	0.04
		Droughty	0.01				
		Depth to bedrock	0.04				
		Organic matter content low	0.50				
111:							
Rizno	60	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Rock fragments	0.41
		Depth to bedrock	0.00				
112:							
Rizno	40	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00			Too sandy	0.99
		Organic matter content low	0.00				
		Too sandy	0.99				
113:							
Arches	25	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00				
		Depth to bedrock	0.00				
		Too alkaline	0.00				
		Organic matter content low	0.50				
114:							
Arches	15	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Too sandy	0.08
		Depth to bedrock	0.00			Slope	0.37
		Too sandy	0.08				
		Organic matter content low	0.50				
115:							
Nalcase	25	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00				
		Depth to bedrock	0.00				
		Organic matter content low	0.00				

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
116:							
Needle--------------	35	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.00
		Droughty	0.00				
		Depth to bedrock	0.00				
		Organic matter content low	0.00				
117:							
Torriorthents-------	45	Poor		Poor		Poor	
		Droughty	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
118:							
Tsaya---------------	45	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Slope	0.00
		Droughty	0.00	Slope	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
		Organic matter content low	0.50				
119:							
Sazi----------------	50	Fair		Poor		Fair	
		Droughty	0.07	Depth to bedrock	0.00	Depth to bedrock	0.32
		Carbonate content	0.08			Carbonate content	0.66
		Depth to bedrock	0.32				
		Organic matter content low	0.50				
Rizno---------------	30	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Too sandy	0.78
		Depth to bedrock	0.00			Rock fragments	0.92
		Organic matter content low	0.00				
		Too sandy	0.78				
120:							
Sheppard family-----	30	Poor		Poor		Poor	
		Too sandy	0.00	Depth to bedrock	0.00	Too sandy	0.00
		Wind erosion	0.00			Depth to bedrock	0.50
		Droughty	0.00				
		Organic matter content low	0.50				
		Depth to bedrock	0.50				
Tsaya family--------	30	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
		Organic matter content low	0.00			Slope	0.00
		Too sandy	0.44			Too sandy	0.44

Table 19.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
120:							
Bluechief family----	20	Poor		Poor		Fair	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.03
		Organic matter content low	0.00			Rock fragments	0.18
		Depth to bedrock	0.03			Too sandy	0.78
		Too sandy	0.78				
121:							
Torriorthents-------	45	Poor		Poor		Poor	
		Organic matter content low	0.00	Depth to bedrock	0.00	Slope	0.00
		Droughty	0.00	Slope	0.00	Rock fragments	0.00
		Stone content	0.19	Stones	0.72	Depth to bedrock	0.26
		Depth to bedrock	0.26	Cobble content	0.82	Too sandy	0.92
		Too sandy	0.92				
		Cobble content	0.95				
122:							
Torriorthents-------	50	Poor		Poor		Poor	
		Organic matter content low	0.00	Slope	0.00	Slope	0.00
		Too alkaline	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Droughty	0.52			Depth to bedrock	0.79
		Depth to bedrock	0.79			Carbonate content	0.94
		Carbonate content	0.92				
123:							
Tsaya family--------	50	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00			Depth to bedrock	0.00
		Organic matter content low	0.00				
Moenkopie-----------	40	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Rock fragments	0.00
		Depth to bedrock	0.00			Too sandy	0.92
		Organic matter content low	0.00				
		Too sandy	0.92				
124:							
Tsaya family--------	65	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Slope	0.00
		Depth to bedrock	0.00	Slope	0.00	Rock fragments	0.00
		Organic matter content low	0.00			Depth to bedrock	0.00
		Too alkaline	0.00				

Table 20.--Ponds and Embankments

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
90:							
Arches	65	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Thin layer	1.00		
91:							
Arches, sand sheet	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
				Thin layer	1.00		
Mido	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00				
92:							
Begay, bedrock substratum	50	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	0.32				
Mido	40	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
93:							
Begay	50	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	0.32				
Ignacio	30	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.99	Depth to water	1.00
		Depth to bedrock	0.99				
94:							
Bluechief	45	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.73	Depth to water	1.00
		Depth to bedrock	0.72	Seepage	0.04		
		Slope	0.32				
Needle	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
95:							
Goblin	90	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00	Piping	1.00		

Table 20.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
96:							
Green River family--	75	Very limited		Very limited		Very limited	
		Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	1.00
				Piping	1.00		
Bebeevar------------	20	Very limited		Very limited		Very limited	
		Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	1.00
97:							
Mathis family-------	45	Very limited		Very limited		Very limited	
		Seepage	1.00	Large stones	1.00	Depth to water	1.00
		Slope	1.00	Seepage	0.90		
Rizno---------------	15	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
98:							
Mellenthin----------	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
Wayneco family------	35	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
				Seepage	0.19		
99:							
Mido family, occasionally flooded-----------	70	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
Green River family--	15	Very limited		Very limited		Very limited	
		Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	1.00
				Seepage	0.43		
100:							
Mido family, sodic--	70	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
101:							
Mido----------------	90	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
102:							
Mido----------------	95	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.92				
103:							
Mido----------------	35	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.68				

Table 20.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
103:							
Batterson-----------	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
				Thin layer	1.00		
104:							
Mido----------------	65	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
Begay---------------	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Ponding	1.00	Depth to water	1.00
105:							
Mido----------------	65	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
Mido family, frequently flooded-	15	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
106:							
Monue---------------	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
Trail---------------	30	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.80	Depth to water	1.00
Nepalto-------------	25	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
107:							
Pensom--------------	45	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Thin layer	0.40		
		Depth to bedrock	0.40				
Mido----------------	40	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.68				
108:							
Reef----------------	60	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
109:							
Reef----------------	65	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.08		
		Seepage	0.57				

Table 20.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
110:							
Rizno	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.68				
Ignacio	35	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.99	Depth to water	1.00
		Depth to bedrock	0.99				
111:							
Rizno	60	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.92	Seepage	0.80		
112:							
Rizno	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.32				
113:							
Arches	25	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
114:							
Arches	15	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00				
115:							
Nalcase	25	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
				Thin layer	1.00		
116:							
Needle	35	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
117:							
Torriorthents	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
118:							
Tsaya	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
119:							
Sazi	50	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.92	Depth to water	1.00
		Depth to bedrock	0.87				
		Slope	0.08				

Table 20.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
119:							
Rizno---------------	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
				Thin layer	1.00		
120:							
Sheppard family-----	30	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.87	Depth to water	1.00
		Depth to bedrock	0.87	Seepage	0.30		
		Slope	0.32				
		Depth to bedrock	0.99	Seepage	0.60		
Tsaya family--------	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00				
		Seepage	0.54				
Bluechief family----	20	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.99	Depth to water	1.00
		Slope	0.32				
121:							
Torriorthents-------	45	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Thin layer	0.94		
		Depth to bedrock	0.93	Large stones	0.72		
122:							
Torriorthents-------	50	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Thin layer	0.77	Depth to water	1.00
		Seepage	1.00				
		Depth to bedrock	0.77				
123:							
Tsaya family--------	50	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Thin layer	1.00		
Moenkopie-----------	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
124:							
Tsaya family--------	65	Very limited		Very limited		Very limited	
		Slope	1.00	Seepage	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Thin layer	1.00		

Table 21.--Engineering Properties

(Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative textu
textures follow the dash.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passin sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
90:									
Arches----------	0-1	*Fine sand, Very fine sand, loamy fine sand	*SP-SM,	*A-2-4,	0	0	100	100	94-99
	1-4	*Fine sand, Loamy fine sand, very fine sand	*SM,	*A-2-4,	0	0	100	100	93-98
	4-9	*Fine sand, Loamy fine sand, very fine sand	*SM,	*A-2-4,	0	0	100	100	93-98
	9-19	*Bedrock			---	---	---	---	---
91:									
Arches, sand sheet----------	0-4	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	88-100
	4-7	*Loamy fine sand, Fine sand	*SM,	*A-2-4,	0	0	93-100	93-100	93-100
	7-10	*Bedrock			---	---	---	---	---
	10-20	*Bedrock			---	---	---	---	---
Mido------------	0-2	*Sand, Loamy fine sand, fine sand	*SM,	*A-2-4,	0	0	100	100	78-83
	2-23	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	94-98
	23-57	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	93-97
	57-60	*Sand, Fine sand, loamy coarse sand	*SP-SM,	*A-2-4,	0	0	87-100	87-100	65-79
	60-70	*Bedrock			---	---	---	---	---
92:									
Begay, bedrock substratum-----	0-4	*Fine sandy loam, Loamy fine sand, loamy sand	*SC-SM,	*A-2-4,	0	0	100	100	83-90
	4-6	*Fine sandy loam, Loamy fine sand, very fine sandy loam	*SC-SM,	*A-2-4,	0	0	93-100	93-100	78-95
	6-16	*Very fine sandy loam, Fine sandy loam	*SC-SM,	*A-4,	0	0	86-100	85-100	83-100
	16-31	*Fine sandy loam, Very fine sandy loam	*SC-SM,	*A-2-4,	0	0	87-100	86-100	77-95
	31-61	*Fine sandy loam, Very fine sandy loam	*SC-SM,	*A-2-4,	0	0	87-100	86-100	77-95
	61-71	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passin sieve number--: 4	10	40
	In				Pct	Pct			
92:									
Mido------------	0-4	*Fine sand	*SP-SM,	*A-3,	0	0	100	100	94-98
	4-8	*Fine sand	*SP-SM,	*A-2-4,	0	0	100	100	93-100
	8-51	*Loamy fine sand, Fine sand	*SM,	*A-2-4,	0	0	97-100	97-100	90-97
	51-79	*Loamy fine sand, Fine sand	*SM,	*A-2-4,	0	0	97-100	97-100	90-97
93:									
Begay-----------	0-4	*Loamy fine sand, Fine sandy loam	*SM,	*A-2-4,	0	0	100	100	94-99
	4-16	*Loamy fine sand, Fine sandy loam	*SM,	*A-2-4,	0	0	100	100	94-100
	16-59	*Fine sandy loam, Loamy fine sand	*SC-SM,	*A-4,	0	0	100	100	88-95
	59-79	*Fine sandy loam, Loamy fine sand	*SC-SM,	*A-2-4,	0	0	100	100	86-91
Ignacio---------	0-4	*Fine sandy loam, Loamy fine sand, fine sand	*SC,	*A-4,	0	0	100	100	82-94
	4-17	*Fine sandy loam	*SC-SM,	*A-4,	0	0	93-100	93-100	84-95
	17-22	*Fine sandy loam, Loamy fine sand, gravelly loamy fine sand	*SC,	*A-4,	0	0	63-100	61-100	51-93
	22-34	*Bedrock			---	---	---	---	---
94:									
Bluechief-------	0-2	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	93-100	93-100	87-100
	2-7	*Loamy fine sand	*SM,	*A-2-4,	0	0	93-100	93-100	87-99
	7-13	*Fine sandy loam, Sandy loam	*SC,	*A-2-4,	0	0	80-100	79-100	72-97
	13-34	*Gravelly fine sandy loam, Sandy loam, fine sandy loam	*SC,	*A-2-4,	0	0	74-100	73-100	65-96
	34-44	*Bedrock			---	---	---	---	---
Needle----------	0-5	*Fine sand, Loamy fine sand, loamy sand	*SP-SM,	*A-2-4,	0	0-6	93-100	93-100	87-100
	5-15	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
95:									
Goblin----------	0-3	*Very gravelly sandy loam, Extremely channery sandy loam, very gravelly fine sandy loam	*GC-GM,	*A-1-b,	0	0	25-56	21-54	16-43
	3-9	*Extremely channery sandy loam, Very gravelly fine sandy loam, very gravelly sandy loam	*GP-GC,	*A-2-4,	0	0	25-56	21-54	16-43
	9-19	*Bedrock			---	---	---	---	---
96:									
Green River family---------	0-4	*Silt loam	*CL,	*A-4,	0	0	100	100	88-96
	4-20	*Silt loam, Loamy very fine sand, fine sand	*CL,	*A-4,	0	0	100	100	79-96
	20-79	*Loamy very fine sand, Fine sand, silt loam	*SC-SM,	*A-4,	0	0	100	100	91-100
Bebeevar--------	0-3	*Loamy fine sand, Loam, silt loam	*SC-SM,	*A-2-4,	0	0	100	100	94-100
	3-16	*Loamy fine sand, Fine sand, silt loam, loam	*SC-SM,	*A-2-4,	0	0	100	100	91-100
	16-43	*Loamy fine sand, Loam, silt loam, fine sand	*SC-SM,	*A-2-4,	0	0	100	100	91-100
	43-71	*Silt loam, Loam, fine sand, loamy fine sand	*CL-ML,	*A-4,	0	0	100	100	87-100
97:									
Mathis family---	0-8	*Very channery loamy sand, Very channery loamy coarse sand, very gravelly sandy loam	*SC-SM,	*A-2-4,	13-27	20-36	74-91	74-91	55-75
	8-71	*Extremely bouldery loamy sand, Very channery coarse sandy loam, very gravelly coarse sandy loam	*SM,	*A-2-4,	26-100	17-36	54-95	53-95	39-77

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
97:									
Rizno-----------	0-1	*Fine sand, Sandy loam, loamy sand	*SM,	*A-2-4,	0	0	87-100	87-100	81-98
	1-4	*Gravelly fine sandy loam, Sandy clay loam, channery loamy very fine sand	*SC-SM,	*A-2-4,	0	0	100	64-100	54-100
	4-14	*Bedrock			---	---	---	---	---
98:									
Mellenthin------	0-4	*Very gravelly loamy fine sand, Gravelly fine sandy loam, sandy loam	*GC-GM,	*A-1-b,	0	0	44-93	41-93	37-93
	4-12	*Very gravelly fine sandy loam, Very gravelly sandy loam, gravelly fine sandy loam	*GC,	*A-2-4,	0	0	34-58	31-56	28-55
	12-16	*Very gravelly sandy loam, Gravelly fine sandy loam, very gravelly fine sandy loam	*GC,	*A-2-4,	0	0	34-58	31-56	22-44
	16-26	*Bedrock			---	---	---	---	---
Wayneco family--	0-2	*Gravelly loamy fine sand, Gravelly sandy loam, very gravelly sandy loam	*GC-GM,	*A-2-4,	0	0	56-77	54-76	51-76
	2-6	*Fine sandy loam, Channery sandy loam	*SC,	*A-4,	0	0	66-94	64-94	55-89
	6-10	*Fine sandy loam, Channery sandy loam	*CL,	*A-6,	0	3-17	79-97	78-97	64-87
	10-15	*Channery sandy loam, Fine sandy loam	*SC,	*A-2-4,	0	3-17	79-97	78-97	69-94
	15-17	*Bedrock			---	---	---	---	---
	17-27	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
99:									
Mido family, occasionally flooded--------	0-3	*Very fine sand, Loamy fine sand	*SM,	*A-4,	0	0	100	100	96-100
	3-12	*Fine sand, Loamy fine sand, sand	*SM,		0	0	94-100	94-100	86-99
	12-18	*Loamy fine sand, Fine sand, sand	*SM,	*A-2,	0	0	94-100	94-100	87-100
	18-44	*Fine sand, Loamy fine sand, sand	*SM,	*A-2,	0	0	94-100	94-100	87-100
	44-66	*Sand, Fine sand, loamy fine sand	*SP-SM,	*A-2, A-3	0	0	94-100	93-100	70-82
	66-76	*Fine sand, Loamy fine sand, sand	*SM,	*A-2,	0	0	94-100	94-100	86-99
Green River family---------	0-1	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	92-99
	1-11	*Very fine sandy loam, Fine sandy loam, loamy coarse sand	*CL,	*A-4,	0	0	100	100	85-100
	11-22	*Very fine sandy loam, Loamy fine sand, loamy coarse sand	*CL,	*A-4,	0	0	100	100	84-100
	22-71	*Fine sand, Loamy fine sand, loamy coarse sand	*SM,	*A-2-4,	0	0	100	100	92-99
100:									
Mido family, sodic----------	0-2	*Fine sand, Fine sandy loam, loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	88-100
	2-4	*Fine sand, Fine sandy loam, loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	88-100
	4-11	*Loamy fine sand, Very fine sandy loam, fine sandy loam	*SM,	*A-2-4,	0	0	94-100	93-100	87-100
	11-18	*Loamy fine sand, Very fine sandy loam, fine sandy loam	*SC-SM,	*A-2-4,	0	0	93-100	93-100	86-100
	18-41	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	87-99
	41-76	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	88-100

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
101:									
Mido------------	0-3	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	97-100	97-100	92-99
	3-24	*Fine sand	*SM,	*A-2-4,	0	0	97-100	97-100	92-98
	24-79	*Loamy fine sand, Fine sand	*SM,	*A-2-4,	0	0	93-100	93-100	84-95
102:									
Mido------------	0-2	*Fine sand, Sand, loamy fine sand	*SP-SM,	*A-2-4,	0	0	94-100	93-100	87-97
	2-11	*Fine sand, Loamy fine sand, loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	83-95
	11-26	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	85-96
	26-67	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	85-96
	67-79	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	94-100	93-100	84-95
103:									
Mido------------	0-4	*Fine sand, Loamy fine sand	*SP-SM,	*A-3,	0	0	100	100	94-100
	4-47	*Fine sand, Loamy fine sand	*SP-SM,	*A-2-4,	0	0	94-100	93-100	88-100
	47-71	*Fine sand, Loamy fine sand, gravelly loamy sand	*SP-SM,	*A-3,	0	0	75-100	74-100	70-99
Batterson-------	0-3	*Fine sand, Loamy fine sand, gravelly loamy coarse sand	*SM,	*A-2-4,	0	0	75-100	74-100	69-98
	3-6	*Very gravelly coarse sand, Gravelly coarse sand, very cobbly loamy coarse sand, very gravelly fine sandy loam	*SP-SM,	*A-1-b,	0	0	46-82	43-81	19-43
	6-7	*Bedrock			---	---	---	---	---
	7-17	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
104:									
Mido------------	0-2	*Fine sand, Loamy fine sand, loamy sand	*SM,	*A-2-4,	0	0	97-100	97-100	90-94
	2-24	*Fine sand, Loamy fine sand, loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	87-100
	24-70	*Fine sand, Loamy fine sand, loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	87-100
	70-79	*Fine sand, Loamy fine sand, loamy sand	*SP-SM,	*A-2-4,	0	0	94-100	93-100	87-100
Begay-----------	0-2	*Loam, Loamy very fine sand	*CL,	*A-4,	0	0	97-100	97-100	75-91
	2-7	*Very fine sandy loam, Fine sandy loam, loamy very fine sand, loam	*CL, CL-ML	*A-4,	0	0	93-100	93-100	85-100
	7-28	*Very fine sandy loam, Loam, loamy very fine sand, fine sandy loam	*CL, CL-ML	*A-4,	0	0	93-100	93-100	84-100
	28-37	*Very fine sandy loam, Loam, loamy very fine sand, fine sandy loam	*CL, CL-ML	*A-4,	0	0	93-100	93-100	83-100
	37-51	*Loamy fine sand, Fine sandy loam, fine sand, loamy sand	*SM, SC-SM	*A-2-4,	0	0	93-100	93-100	88-100
	51-76	*Loamy fine sand, Loamy sand, fine sand, fine sandy loam	*SM, SC-SM	*A-2-4,	0	0	93-100	93-100	88-100
105:									
Mido------------	0-8	*Fine sand	*SP-SM,	*A-3,	0	0	100	100	94-98
	8-36	*Fine sand	*SP-SM,	*A-2-4,	0	0	100	100	94-98
	36-49	*Fine sand	*SP-SM,	*A-2-4,	0	0	94-100	93-100	88-98
	49-59	*Gravelly sand, Gravelly fine sand	*SP-SM,	*A-3,	0	0	36-75	32-74	25-60
Mido family, frequently flooded--------	0-4	*Sand, Fine sand	*SP-SM,	*A-3,	0	0	100	100	77-81
	4-22	*Coarse sand, Fine sand, sand	*SP-SM,	*A-1-b,	0	0	100	100	44-48
	22-39	*Sand, Coarse sand, fine sand	*SP-SM,	*A-3,	0	0	87-100	87-100	66-81
	39-71	*Coarse sand, Sand, fine sand	*SP-SM,	*A-1-b,	0	0	88-100	87-100	37-47

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passin sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
106:									
Monue----------	0-4	*Loamy very fine sand, Very fine sandy loam, loamy fine sand	*SM,	*A-4,	0	0	93-100	93-100	91-100
	4-31	*Very fine sandy loam, Fine sandy loam	*CL,	*A-4,	0	0	86-100	85-100	82-100
	31-60	*Gravelly sand, Loamy fine sand, very gravelly loamy sand	*SP-SM,	*A-3,	0	0	65-100	63-100	49-86
Trail----------	0-3	*Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	93-98
	3-16	*Loamy fine sand, Loamy sand	*SM,	*A-2-4,	0	0	93-100	93-100	87-98
	16-43	*Loamy fine sand, Sand, fine sand, coarse sand	*SP-SM,	*A-2-4,	0	0	87-100	87-100	65-84
	43-71	*Loamy fine sand, Coarse sand, fine sand, sand	*SM,	*A-2-4,	0	0	87-100	86-100	77-98
Nepalto---------	0-4	*Sand, Loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	71-82
	4-10	*Very gravelly sand, Gravelly loamy sand	*GP-GM,	*A-1-b,	0	0-13	30-59	26-57	20-48
	10-60	*Very gravelly sand, Gravelly loamy sand	*GP-GM,	*A-1-b,	0	0-13	30-59	26-57	20-47
107:									
Pensom----------	0-4	*Fine sand	*SM,	*A-2-4,	0	0	100	100	92-96
	4-20	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	93-99
	20-35	*Fine sand, Loamy fine sand	*SM,	*A-2-4,	0	0	100	100	93-99
	35-41	*Loamy fine sand, Fine sand	*SM,	*A-4,	0	0	97-100	97-100	87-95
	41-51	*Bedrock			0	0	---	---	---
Mido-----------	0-3	*Fine sand	*SP-SM,	*A-2-4,	0	0	100	100	94-98
	3-16	*Fine sand, Loamy fine sand	*SP-SM,	*A-2-4,	0	0	100	100	93-99
	16-27	*Fine sand, Loamy fine sand	*SP-SM,	*A-3,	0	0	100	100	94-100
	27-79	*Fine sand, Loamy fine sand	*SP-SM,	*A-3,	0	0	100	100	94-100

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
108:									
Reef------------	0-4	*Very gravelly coarse sandy loam, Extremely channery sandy loam	*GP-GC,	*A-1-a,	0	0-34	35-69	26-62	15-38
	4-5	*Bedrock			---	---	---	---	---
	5-15	*Bedrock			---	---	---	---	---
109:									
Reef------------	0-4	*Very channery loam, Very channery fine sandy loam, extremely channery fine sandy loam	*GC,	*A-4,	0	22-41	32-71	30-71	25-65
	4-13	*Bedrock			---	---	---	---	---
	13-23	*Bedrock			---	---	---	---	---
110:									
Rizno-----------	0-2	*Very fine sand, Fine sandy loam, loamy fine sand	*SM,	*A-4,	0	0	93-100	93-100	92-100
	2-6	*Very fine sandy loam, Fine sandy loam, loamy very fine sand	*SC-SM,	*A-4,	0	0-10	88-100	88-100	81-100
	6-16	*Bedrock			---	---	---	---	---
Ignacio---------	0-3	*Fine sandy loam, Loamy fine sand	*SC,	*A-6,	0	0	93-100	93-100	77-95
	3-22	*Fine sandy loam	*SC,	*A-4,	0	0	93-100	93-100	81-96
	22-32	*Bedrock			---	---	---	---	---
111:									
Rizno-----------	0-2	*Gravelly sandy loam, Gravelly loamy coarse sand, loamy sand	*SC-SM,	*A-1-b,	0	0	63-93	61-93	45-74
	2-4	*Channery sandy loam, Sandy loam	*SC,	*A-2-4,	0	0	63-87	61-86	43-67
	4-6	*Bedrock			---	---	---	---	---
	6-15	*Bedrock			---	---	---	---	---
112:									
Rizno-----------	0-1	*Fine sandy loam, Very fine sandy loam	*SC-SM,	*A-4,	0	0	93-100	93-100	82-92
	1-6	*Fine sandy loam, Sandy loam, very fine sandy loam	*SC,	*A-2-4,	0	0	93-100	93-100	66-76
	6-15	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
113:									
Arches----------	0-9	*Fine sand, Loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	87-99
	9-19	*Fine sand, Loamy sand	*SM,	*A-2-4,	0	0	94-100	93-100	85-99
	19-29	*Bedrock			---	---	---	---	---
114:									
Arches----------	0-4	*Loamy fine sand, Fine sand, loamy sand	*SM,	*A-2-4,	0	0	93-100	93-100	86-97
	4-8	*Loamy fine sand, Fine sand	*SC-SM,	*A-2-4,	0	0-6	93-100	93-100	80-95
	8-18	*Bedrock			---	---	---	---	---
115:									
Nalcase---------	0-2	*Fine sand	*SM,	*A-2-4,	0	0	100	100	94-96
	2-6	*Fine sand	*SM,	*A-2-4,	0	0	100	100	94-96
	6-9	*Bedrock			---	---	---	---	---
	9-19	*Bedrock			---	---	---	---	---
116:									
Needle----------	0-4	*Fine sand	*SP-SM,	*A-2-4,	0	0	100	100	94-96
	4-11	*Fine sand	*SM,	*A-2-4,	0	0	97-100	97-100	90-94
	11-21	*Bedrock			---	---	---	---	---
117:									
Torriorthents---	0-2	*Very gravelly sandy loam, Gravelly sandy loam, loamy coarse sand, extremely stony loamy coarse sand	*GC,	*A-2-6,	0-78	0-27	28-93	25-93	16-76
	2-12	*Bedrock			---	---	---	---	---
118:									
Tsaya-----------	0-4	*Very channery loam, Channery sandy loam, very gravelly sandy loam	*GC,	*A-2-6,	0	0	18-58	14-56	11-52
	4-7	*Bedrock			---	---	---	---	---
	7-17	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
119:									
Sazi------------	0-4	*Fine sandy loam, Fine sand	*SC-SM,	*A-4,	0	0	100	100	81-90
	4-11	*Fine sandy loam, Fine sand	*SC-SM,	*A-4,	0	0	100	100	81-90
	11-28	*Sandy loam, Fine sandy loam	*SC,	*A-2-4,	0	0	93-100	93-100	59-74
	28-30	*Bedrock			---	---	---	---	---
	30-43	*Bedrock			---	---	---	---	---
Rizno-----------	0-3	*Gravelly loamy coarse sand, Fine sandy loam, loamy fine sand	*SP-SM,	*A-1-b,	0	0	70-94	68-93	35-60
	3-10	*Sandy loam, Gravelly sandy loam, very gravelly sandy loam	*SC-SM,	*A-2-4,	0	0	53-87	50-86	37-70
	10-20	*Bedrock			---	---	---	---	---
120:									
Sheppard family-	0-4	*Fine sand	*SM,	*A-2-4,	0	0	99-100	99-100	93-98
	4-20	*Loamy fine sand, Fine sand	*SC-SM,	*A-2-4,	0	0	81-100	80-100	71-97
	20-30	*Loamy fine sand, Fine sand	*SC-SM,	*A-2-4,	0	0	81-100	80-100	69-95
	30-39	*Bedrock			---	---	---	---	---
Tsaya family----	0-3	*Fine sandy loam, Sandy loam, gravelly sandy loam	*SC-SM,	*A-2-4,	0	0	62-93	60-93	53-87
	3-10	*Very gravelly fine sandy loam, Very gravelly sandy loam	*GP-GC,	*A-1-b,	0	0-36	25-53	22-51	19-49
	10-20	*Bedrock			---	---	---	---	---
Bluechief family	0-4	*Gravelly sandy loam, Sandy loam, loamy fine sand	*SC,	*A-2-4,	0	0	64-100	62-100	42-74
	4-22	*Channery sandy loam, Gravelly sandy loam	*SC,	*A-2-4,	0	0-19	52-100	51-100	36-76
	22-32	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passin sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
121:									
Torriorthents---	0-4	*Very gravelly sandy loam, Loam, silt loam, very channery sandy loam	*GC,	*A-2-4,	0	0-36	34-100	32-100	22-79
	4-27	*Very cobbly sandy loam, Channery loam, extremely channery sandy loam, clay loam, gravelly coarse sandy loam	*GC,	*A-2-4,	0-14	0-82	19-100	16-100	11-95
	27-37	*Bedrock			---	---	---	---	---
122:									
Torriorthents---	0-4	*Fine sandy loam, Gravelly coarse sand, gravelly loamy sand, sandy loam	*SC,	*A-4,	0	0	71-100	70-100	58-93
	4-16	*Fine sandy loam, Loamy coarse sand, loamy sand, very gravelly loamy coarse sand, sandy clay loam, sandy loam	*SC,	*A-6,	0	0-31	36-100	34-100	30-100
	16-33	*Gravelly fine sandy loam, Sandy loam, sandy clay loam, very gravelly loamy coarse sand, loamy sand, loamy coarse sand, fine sandy loam	*SC,	*A-2-6,	0-3	0-31	36-100	34-100	28-100
	33-43	*Bedrock			---	---	---	---	---

Table 21.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passin sieve number--		
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40
	In				Pct	Pct			
123:									
Tsaya family----	0-4	*Sandy loam, Extremely channery loamy coarse sand, very channery loamy coarse sand	*GC-GM,	*A-2-4,	0	0	26-80	22-79	16-66
	4-9	*Coarse sandy loam, Extremely channery sandy loam, very channery coarse sandy loam	*GC,	*A-2-4,	0	0	18-58	14-56	8-37
	9-16	*Extremely channery sandy loam, Very channery sandy loam, very channery coarse sandy loam, very gravelly coarse sandy loam	*GC,	*A-2-6,	0	0	18-58	14-56	10-44
	16-26	*Bedrock			---	---	---	---	---
Moenkopie-------	0-2	*Loamy sand, Sandy loam	*SC-SM,	*A-2-4,	0	0	81-87	80-86	64-76
	2-8	*Channery sandy loam, Very channery coarse sandy loam, coarse sandy loam	*SC,	*A-2-4,	0	0	34-87	31-86	22-68
	8-18	*Bedrock			---	---	---	---	---
124:									
Tsaya family----	0-2	*Very gravelly sandy loam, Extremely gravelly loam	*GC-GM,	*A-2-4,	0	0	26-80	22-79	16-66
	2-11	*Extremely gravelly sandy loam, Extremely gravelly loam	*GC,	*A-2-4,	0	0	18-58	14-56	8-37
	11-21	*Bedrock			---	---	---	---	---

Table 22.--Physical Soil Properties

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind
apply only to the surface layer. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
90:											
Arches--------------	0-1	86-99	0-9	1-6	1.50-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.20	.2
	1-4	86-99	0-9	1-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.24	.2
	4-9	86-99	0-9	1-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.24	.2
	9-19	---	---	---	---	0.00-0.2	---	---	---	---	--
91:											
Arches, sand sheet--	0-4	82-98	1-12	2-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.24	.2
	4-7	77-95	2-17	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.28	.2
	7-10	---	---	---	---	0.2-0.6	---	---	---	---	--
	10-20	---	---	---	---	0.00-0.2	---	---	---	---	--
Mido----------------	0-2	82-98	1-12	1-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.05	.0
	2-23	82-98	1-12	1-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.15	.1
	23-57	82-98	1-12	1-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	57-60	82-99	0-12	1-5	1.60-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	60-70	---	---	---	---	0.2-0.6	---	---	---	---	--
92:											
Begay, bedrock substratum---------	0-4	77-89	3-23	3-10	1.50-1.65	2-20	0.07-0.14	0.0-2.9	0.0-2.0	.24	.2
	4-6	75-89	9-33	4-15	1.45-1.65	2-20	0.09-0.14	0.0-2.9	0.0-1.0	.28	.2
	6-16	60-85	6-26	10-15	1.45-1.60	2-6	0.14-0.16	0.0-2.9	0.0-1.0	.43	.4
	16-31	60-85	6-26	10-15	1.45-1.60	2-6	0.14-0.16	0.0-2.9	0.0-1.0	.28	.2
	31-61	60-85	6-26	10-15	1.45-1.60	2-6	0.14-0.16	0.0-2.9	0.0-0.5	.28	.2
	61-71	---	---	---	---	0.00-0.2	---	---	---	---	--
Mido----------------	0-4	86-99	0-9	1-5	1.60-1.70	20-100	0.06-0.07	0.0-2.9	0.0-2.0	.10	.1
	4-8	86-99	0-9	1-8	1.60-1.70	20-100	0.06-0.07	0.0-2.9	0.0-1.0	.10	.1
	8-51	72-88	7-23	1-5	1.55-1.70	6-100	0.06-0.09	0.0-2.9	0.0-0.5	.32	.3
	51-79	72-88	7-23	1-5	1.55-1.70	6-20	0.06-0.09	0.0-2.9	0.0-0.5	.32	.3
93:											
Begay---------------	0-4	77-89	4-17	5-10	1.50-1.65	2-20	0.09-0.14	0.0-2.9	0.0-2.0	.28	.2
	4-16	75-89	4-20	5-15	1.50-1.65	2-20	0.09-0.14	0.0-2.9	0.0-1.0	.32	.3
	16-59	60-85	6-26	8-15	1.50-1.65	2-20	0.09-0.14	0.0-2.9	0.0-1.0	.28	.2
	59-79	60-85	6-26	5-10	1.50-1.65	2-20	0.09-0.14	0.0-2.9	0.0-0.5	.28	.2
Ignacio-------------	0-4	60-87	6-26	3-15	1.50-1.70	2-100	0.06-0.14	0.0-2.9	0.0-2.0	.24	.2
	4-17	60-85	6-26	10-15	1.50-1.60	2-6	0.13-0.14	0.0-2.9	0.0-1.0	.24	.2
	17-22	60-85	6-26	5-15	1.55-1.60	2-20	0.05-0.14	0.0-2.9	0.0-1.0	.24	.2
	22-34	---	---	---	---	0.2-0.6	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
94:											
Bluechief-----------	0-2	77-94	4-17	2-8	1.55-1.70	6-100	0.06-0.09	0.0-2.9	0.0-1.0	.17	.1
	2-7	77-89	4-17	5-10	1.55-1.65	6-20	0.08-0.09	0.0-2.9	0.0-1.0	.32	.3
	7-13	60-84	6-26	12-18	1.50-1.60	2-6	0.12-0.14	0.0-2.9	0.0-1.0	.24	.2
	13-34	58-84	6-26	12-18	1.50-1.60	2-6	0.12-0.14	0.0-2.9	0.0-0.5	.15	.2
	34-44	---	---	---	---	0.00-0.2	---	---	---	---	--
Needle--------------	0-5	82-99	0-12	1-12	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.10	.1
	5-15	---	---	---	---	0.00-0.2	---	---	---	---	--
95:											
Goblin--------------	0-3	60-85	6-26	10-15	1.40-1.50	2-6	0.04-0.09	0.0-2.9	0.0-2.0	.10	.2
	3-9	60-85	6-26	10-15	1.40-1.50	2-6	0.04-0.09	0.0-2.9	0.0-0.5	.05	.2
	9-19	---	---	---	---	0.00-0.2	---	---	---	---	--
96:											
Green River family--	0-4	10-40	50-80	10-18	1.40-1.50	0.6-2	0.17-0.20	0.0-2.9	1.0-2.0	.49	.4
	4-20	10-90	10-70	1-18	1.45-1.70	0.6-100	0.06-0.20	0.0-2.9	0.0-0.5	.49	.4
	20-79	30-90	6-65	1-18	1.45-1.70	0.6-100	0.06-0.20	0.0-2.9	0.0-0.5	.49	.4
Bebeevar------------	0-3	30-90	4-55	5-20	1.45-1.65	0.6-20	0.09-0.20	0.0-2.9	0.0-2.0	.24	.2
	3-16	30-90	4-55	3-25	1.45-1.70	0.6-100	0.06-0.20	0.0-2.9	0.0-0.5	.24	.2
	16-43	30-90	4-55	3-25	1.45-1.70	0.6-100	0.06-0.20	0.0-2.9	0.0-0.5	.24	.2
	43-71	20-88	4-70	3-25	1.45-1.70	0.6-100	0.06-0.20	0.0-2.9	0.0-0.5	.55	.5
97:											
Mathis family-------	0-8	77-89	5-17	2-10	1.50-1.65	2-20	0.04-0.08	0.0-2.9	0.0-2.0	.05	.1
	8-71	77-89	5-17	2-10	1.55-1.65	6-20	0.02-0.08	0.0-2.9	0.0-0.5	.02	.1
Rizno---------------	0-1	84-99	0-10	5-10	1.50-1.70	2-100	0.05-0.12	0.0-2.9	0.0-2.0	.24	.2
	1-4	60-85	6-26	5-25	1.45-1.65	0.6-20	0.07-0.15	0.0-2.9	0.0-0.5	.20	.3
	4-14	---	---	---	---	0.00-0.2	---	---	---	---	--
98:											
Mellenthin----------	0-4	76-89	7-19	5-15	1.50-1.65	2-20	0.05-0.12	0.0-2.9	0.0-2.0	.10	.3
	4-12	60-85	6-26	10-18	1.50-1.60	2-6	0.06-0.09	0.0-2.9	0.0-1.0	.10	.3
	12-16	60-85	6-26	10-18	1.50-1.60	2-6	0.05-0.11	0.0-2.9	0.0-1.0	.10	.2
	16-26	---	---	---	---	0.00-0.2	---	---	---	---	--
Wayneco family------	0-2	79-89	4-18	8-18	1.50-1.65	2-20	0.05-0.10	0.0-2.9	0.0-2.0	.20	.3
	2-6	60-85	6-26	8-18	1.50-1.60	2-6	0.08-0.14	0.0-2.9	0.0-1.0	.32	.3
	6-10	53-84	6-36	10-18	1.50-1.60	2-6	0.08-0.14	0.0-2.9	0.0-1.0	.32	.3
	10-15	60-85	6-26	10-18	1.50-1.60	2-6	0.08-0.14	0.0-2.9	0.0-1.0	.15	.2
	15-17	---	---	---	---	0.2-0.6	---	---	---	---	--
	17-27	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
99:											
Mido family, occasionally flooded-----------	0-3	82-98	1-17	1-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.49	.4
	3-12	82-98	1-17	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.15	.1
	12-18	77-95	4-17	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.32	.3
	18-44	82-99	0-12	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	44-66	82-99	0-12	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.10	.1
	66-76	82-98	1-12	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
Green River family--	0-1	82-98	1-12	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.15	.1
	1-11	52-82	6-36	1-18	1.45-1.70	2-20	0.09-0.16	0.0-2.9	0.0-0.5	.49	.4
	11-22	52-82	6-30	1-18	1.45-1.70	2-20	0.09-0.16	0.0-2.9	0.0-0.5	.43	.4
	22-71	82-98	1-12	1-8	1.55-1.70	2-20	0.05-0.09	0.0-2.9	0.0-0.5	.17	.1
100:											
Mido family, sodic--	0-2	77-97	0-17	3-10	1.50-1.70	2-100	0.05-0.14	0.0-2.9	0.0-2.0	.15	.1
	2-4	77-97	0-17	3-10	1.50-1.70	2-100	0.05-0.14	0.0-2.9	0.0-2.0	.15	.1
	4-11	72-89	4-20	5-15	1.50-1.70	2-100	0.05-0.14	0.0-2.9	0.0-1.0	.28	.2
	11-18	72-89	4-20	5-15	1.50-1.70	2-100	0.09-0.14	0.0-2.9	0.0-1.0	.24	.2
	18-41	77-97	0-17	3-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	41-76	77-98	0-17	2-15	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.17	.1
101:											
Mido----------------	0-3	85-98	0-12	2-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.15	.1
	3-24	86-98	0-9	2-6	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.15	.1
	24-79	77-89	4-17	2-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.32	.3
102:											
Mido----------------	0-2	80-99	0-18	1-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.10	.1
	2-11	80-99	0-18	0-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.15	.1
	11-26	77-99	1-17	0-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	26-67	77-99	1-17	0-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	67-79	77-99	1-17	0-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
103:											
Mido----------------	0-4	82-99	0-12	1-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.10	.1
	4-47	82-99	0-12	1-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.10	.1
	47-71	82-98	1-12	1-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
Batterson-----------	0-3	82-98	1-12	1-5	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.24	.2
	3-6	82-98	1-12	1-10	1.50-1.80	2-100	0.06-0.14	0.0-2.9	0.0-0.5	.05	.1
	6-7	---	---	---	---	0.2-0.6	---	---	---	---	--
	7-17	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
104:											
Mido----------------	0-2	77-98	1-17	1-3	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.10	.1
	2-24	79-98	1-17	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.15	.1
	24-70	79-98	1-17	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	70-79	79-98	1-17	1-8	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
Begay---------------	0-2	35-71	28-49	5-18	1.45-1.65	2-20	0.09-0.17	0.0-2.9	0.0-2.0	.37	.3
	2-7	50-82	6-35	5-18	1.45-1.65	2-20	0.09-0.17	0.0-2.9	0.0-1.0	.49	.4
	7-28	50-82	6-35	5-18	1.45-1.65	2-20	0.09-0.17	0.0-2.9	0.0-1.0	.49	.4
	28-37	50-82	6-35	5-18	1.45-1.65	2-20	0.09-0.17	0.0-2.9	0.0-1.0	.49	.4
	37-51	70-89	4-20	5-18	1.50-1.70	2-100	0.06-0.14	0.0-2.9	0.0-0.5	.28	.2
	51-76	70-89	4-20	5-18	1.50-1.70	2-100	0.06-0.14	0.0-2.9	0.0-0.5	.28	.2
105:											
Mido----------------	0-8	86-99	0-9	1-5	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-2.0	.10	.1
	8-36	86-99	0-9	1-5	1.55-1.70	20-100	0.05-0.06	0.0-2.9	0.0-1.0	.10	.1
	36-49	86-99	0-9	1-5	1.55-1.70	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.15	.1
	49-59	86-99	0-9	1-5	1.55-1.70	20-100	0.03-0.06	0.0-2.9	0.0-0.5	.05	.1
Mido family, frequently flooded-	0-4	86-99	0-9	1-5	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-2.0	.05	.0
	4-22	86-99	0-9	1-5	1.60-1.80	20-100	0.05-0.06	0.0-2.9	0.0-1.0	.05	.0
	22-39	86-99	0-9	1-5	1.60-1.80	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.05	.0
	39-71	86-99	0-9	1-5	1.60-1.80	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.05	.0
106:											
Monue---------------	0-4	77-95	4-17	5-12	1.45-1.65	2-20	0.09-0.16	0.0-2.9	0.0-1.0	.55	.5
	4-31	57-82	6-30	10-15	1.45-1.60	2-6	0.14-0.16	0.0-2.9	0.0-0.5	.49	.4
	31-60	82-98	1-15	1-10	1.55-1.70	6-100	0.04-0.09	0.0-2.9	0.0-0.5	.05	.1
Trail---------------	0-3	77-89	4-17	5-10	1.55-1.65	6-20	0.08-0.09	0.0-2.9	0.0-1.0	.28	.2
	3-16	77-89	4-17	5-10	1.55-1.65	6-20	0.07-0.09	0.0-2.9	0.0-1.0	.28	.2
	16-43	86-99	0-9	1-10	1.55-1.70	6-100	0.06-0.09	0.0-2.9	0.0-0.5	.24	.2
	43-71	77-95	2-17	1-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.28	.2
Nepalto-------------	0-4	82-98	0-12	2-8	1.55-1.70	6-100	0.05-0.07	0.0-2.9	0.0-1.0	.10	.1
	4-10	82-98	0-12	2-8	1.55-1.70	6-100	0.03-0.06	0.0-2.9	0.0-0.5	.02	.1
	10-60	82-98	0-12	2-8	1.55-1.70	6-100	0.03-0.06	0.0-2.9	0.0-0.5	.02	.1
107:											
Pensom--------------	0-4	86-98	1-9	1-5	1.60-1.70	20-100	0.05-0.07	0.0-2.9	0.0-1.0	.15	.1
	4-20	82-98	1-12	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	20-35	82-98	1-12	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	35-41	---	1-18	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	41-51	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
107:											
Mido----------------	0-3	86-98	1-9	1-5	1.60-1.70	20-100	0.05-0.07	0.0-2.9	0.0-1.0	.15	.1
	3-16	82-98	1-12	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	16-27	82-98	1-12	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
	27-79	82-98	1-12	1-7	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.15	.1
108:											
Reef----------------	0-4	60-85	6-26	9-14	1.50-1.60	2-6	0.05-0.08	0.0-2.9	0.0-2.0	.05	.2
	4-5	---	---	---	---	0.2-0.6	---	---	---	---	--
	5-15	---	---	---	---	0.00-0.2	---	---	---	---	--
109:											
Reef----------------	0-4	35-60	25-49	8-18	1.45-1.60	0.6-6	0.09-0.11	0.0-2.9	0.0-2.0	.15	.4
	4-13	---	---	---	---	0.2-2	---	---	---	---	--
	13-23	---	---	---	---	0.00-2	---	---	---	---	--
110:											
Rizno---------------	0-2	72-96	0-15	4-10	1.50-1.65	2-100	0.06-0.14	0.0-2.9	0.0-2.0	.55	.5
	2-6	60-88	6-26	5-15	1.45-1.65	2-20	0.08-0.16	0.0-2.9	0.0-1.0	.55	.5
	6-16	---	---	---	---	0.00-0.2	---	---	---	---	--
Ignacio-------------	0-3	60-88	6-26	6-18	1.50-1.65	2-20	0.09-0.14	0.0-2.9	0.0-2.0	.24	.2
	3-22	60-84	6-26	10-18	1.50-1.60	2-6	0.13-0.15	0.0-2.9	0.0-1.0	.24	.2
	22-32	---	---	---	---	0.00-0.2	---	---	---	---	--
111:											
Rizno---------------	0-2	60-85	6-26	8-15	1.50-1.65	2-20	0.05-0.12	0.0-2.9	0.0-2.0	.15	.2
	2-4	60-85	6-26	10-18	1.50-1.60	2-6	0.08-0.11	0.0-2.9	0.0-1.0	.20	.2
	4-6	---	---	---	---	0.2-0.6	---	0.0-2.9	---	---	--
	6-15	---	---	---	---	0.00-0.2	---	---	---	---	--
112:											
Rizno---------------	0-1	60-85	6-26	8-12	1.45-1.60	2-6	0.13-0.16	0.0-2.9	0.0-2.0	.24	.2
	1-6	60-85	6-26	10-15	1.45-1.60	2-6	0.13-0.16	0.0-2.9	0.0-0.5	.28	.2
	6-15	---	---	---	---	0.00-0.2	---	---	---	---	--
113:											
Arches--------------	0-9	85-98	1-12	0-6	1.55-1.70	6-100	0.05-0.07	0.0-2.9	0.0-2.0	.24	.2
	9-19	85-99	1-12	0-8	1.55-1.70	6-100	0.05-0.07	0.0-2.9	0.0-1.0	.24	.2
	19-29	---	---	---	---	0.00-0.2	---	---	---	---	--
114:											
Arches--------------	0-4	77-95	2-17	2-6	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-2.0	.32	.3
	4-8	77-95	2-17	2-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-1.0	.32	.3
	8-18	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
115:											
Nalcase-------------	0-2	86-99	0-9	1-3	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-1.0	.15	.1
	2-6	86-99	0-9	1-3	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.15	.1
	6-9	---	---	---	---	0.2-0.6	---	---	---	---	--
	9-19	---	---	---	---	0.00-0.2	---	---	---	---	--
116:											
Needle--------------	0-4	86-99	0-12	1-3	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-1.0	.24	.2
	4-11	84-99	0-9	1-3	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-0.5	.24	.2
	11-21	---	---	---	---	0.00-0.2	---	---	---	---	--
117:											
Torriorthents-------	0-2	60-88	6-26	2-20	1.50-1.70	2-20	0.02-0.12	0.0-2.9	0.0-0.5	.10	.2
	2-12	---	---	---	---	0.00-0.2	---	---	---	---	--
118:											
Tsaya---------------	0-4	30-51	28-49	10-25	1.45-1.60	2-6	0.02-0.11	0.0-2.9	0.0-1.0	.17	.4
	4-7	---	---	---	---	0.2-0.6	---	---	---	---	--
	7-17	---	---	---	---	0.00-0.2	---	---	---	---	--
119:											
Sazi----------------	0-4	60-88	4-26	1-10	1.50-1.70	2-100	0.06-0.14	0.0-2.9	0.0-2.0	.28	.2
	4-11	60-88	4-26	1-10	1.50-1.70	2-100	0.06-0.14	0.0-2.9	0.0-1.0	.28	.2
	11-28	60-85	6-26	5-15	1.50-1.60	2-6	0.12-0.14	0.0-2.9	0.0-1.0	.24	.2
	28-30	---	---	---	---	0.2-0.6	---	---	---	---	--
	30-43	---	---	---	---	0.00-0.2	---	---	---	---	--
Rizno---------------	0-3	77-88	4-17	2-15	1.50-1.70	2-20	0.06-0.14	0.0-2.9	0.0-2.0	.15	.2
	3-10	60-85	6-26	8-15	1.50-1.60	2-6	0.11-0.13	0.0-2.9	0.0-0.5	.28	.2
	10-20	---	---	---	---	0.00-0.2	---	---	---	---	--
120:											
Sheppard family-----	0-4	86-98	1-9	1-5	1.60-1.70	20-100	0.05-0.06	0.0-2.9	0.0-2.0	.15	.1
	4-20	77-95	2-17	2-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.24	.2
	20-30	77-95	2-17	2-10	1.55-1.70	6-100	0.05-0.09	0.0-2.9	0.0-0.5	.32	.3
	30-39	---	---	---	---	0.00-0.2	---	---	---	---	--
Tsaya family--------	0-3	60-85	6-26	8-15	1.50-1.60	2-6	0.05-0.14	0.0-2.9	0.0-1.0	.28	.2
	3-10	60-85	6-26	8-15	1.50-1.60	2-6	0.04-0.08	0.0-2.9	0.0-0.5	.10	.3
	10-20	---	---	---	---	0.2-2	---	---	---	---	--
Bluechief family----	0-4	60-85	6-26	8-15	1.50-1.65	2-20	0.06-0.12	0.0-2.9	0.0-1.0	.15	.2
	4-22	60-85	6-26	10-15	1.50-1.60	2-6	0.07-0.10	0.0-2.9	0.0-0.5	.15	.2
	22-32	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 22.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion f	
										Kw	Kf
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct		
121:											
Torriorthents-------	0-4	35-85	10-50	10-18	1.45-1.60	0.6-6	0.06-0.20	0.0-2.9	0.0-1.0	.10	.2
	4-27	40-85	10-37	10-35	1.40-1.60	2-20	0.02-0.20	0.0-2.9	0.0-0.5	.10	.2
	27-37	---	---	---	---	0.00-0.2	---	---	---	---	--
122:											
Torriorthents-------	0-4	60-90	4-26	5-15	1.50-1.80	2-100	0.05-0.14	0.0-2.9	0.0-1.0	.24	.2
	4-16	55-90	4-26	10-35	1.45-1.70	0.6-100	0.03-0.15	0.0-2.9	0.0-0.5	.28	.2
	16-33	55-90	4-26	10-35	1.45-1.70	0.6-100	0.03-0.16	0.0-2.9	0.0-0.5	.20	.3
	33-43	---	---	---	---	0.00-0.2	---	---	---	---	--
123:											
Tsaya family--------	0-4	60-85	6-26	8-18	1.50-1.70	2-20	0.03-0.10	0.0-2.9	0.0-1.0	.28	.2
	4-9	60-85	6-26	10-20	1.50-1.70	2-20	0.02-0.08	0.0-2.9	0.0-0.5	.28	.2
	9-16	60-85	6-26	10-20	1.50-1.70	2-20	0.02-0.08	0.0-2.9	0.0-0.5	.05	.2
	16-26	---	---	---	---	0.00-0.2	---	---	---	---	--
Moenkopie-----------	0-2	77-88	5-17	9-18	1.50-1.65	2-20	0.05-0.11	0.0-2.9	0.0-1.0	.20	.2
	2-8	60-85	6-26	10-18	1.50-1.60	2-20	0.05-0.11	0.0-2.9	0.0-0.5	.17	.2
	8-18	---	---	---	---	0.00-0.2	---	---	---	---	--
124:											
Tsaya family--------	0-2	40-85	0-30	10-18	1.45-1.60	2-6	0.04-0.11	0.0-2.9	0.0-1.0	.10	.2
	2-11	40-85	0-30	10-20	1.45-1.60	2-6	0.04-0.11	0.0-2.9	0.0-0.5	.05	.2
	11-21	---	---	---	---	0.00-0.2	---	---	---	---	--

Table 23.--Erosion Properties of Soils

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map symbol and soil name	Depth Inches	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
		Kw	Kf	T		
90:						
Arches	0-1	.20	.20	1	1	310
	1-4	.24	.24			
	4-9	.24	.24			
	9-19	---	---			
91:						
Arches, sand sheet	0-4	.24	.24	1	1	250
	4-7	.28	.28			
	7-10	---	---			
	10-20	---	---			
Mido	0-2	.05	.05	5	1	220
	2-23	.15	.15			
	23-57	.15	.15			
	57-60	.15	.15			
	60-70	---	---			
92:						
Begay, bedrock substratum	0-4	.24	.24	5	3	86
	4-6	.28	.28			
	6-16	.43	.43			
	16-31	.28	.28			
	31-61	.28	.28			
	61-71	---	---			
Mido	0-4	.10	.10	5	1	250
	4-8	.10	.10			
	8-51	.32	.32			
	51-79	.32	.32			
93:						
Begay	0-4	.28	.28	5	2	134
	4-16	.32	.32			
	16-59	.28	.28			
	59-79	.28	.28			
Ignacio	0-4	.24	.24	2	3	86
	4-17	.24	.24			
	17-22	.24	.24			
	22-34	---	---			
94:						
Bluechief	0-2	.17	.17	2	2	134
	2-7	.32	.32			
	7-13	.24	.24			
	13-34	.15	.24			
	34-44	---	---			
Needle	0-5	.10	.10	1	1	250
	5-15	---	---			

Table 23.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth Inches	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
95:						
Goblin	0-3	.10	.28	1	6	48
	3-9	.05	.28			
	9-19	---	---			
96:						
Green River Family	0-4	.49	.49	5	4L	86
	4-20	.49	.49			
	20-79	.49	.49			
Bebeevar	0-3	.24	.24	5	2	134
	3-16	.24	.24			
	16-43	.24	.24			
	43-71	.55	.55			
97:						
Mathis Family	0-8	.05	.15	2	3	86
	8-71	.02	.17			
Rizno	0-1	.24	.24	1	1	250
	1-4	.20	.32			
	4-14	---	---			
98:						
Mellenthin	0-4	.10	.32	1	2	180
	4-12	.10	.32			
	12-16	.10	.28			
	16-26	---	---			
Wayneco Family	0-2	.20	.32	1	2	160
	2-6	.32	.32			
	6-10	.32	.32			
	10-15	.15	.28			
	15-17	---	---			
	17-27	---	---			
99:						
Mido Family, occasionally flooded	0-3	.49	.49	5	1	310
	3-12	.15	.15			
	12-18	.32	.32			
	18-44	.15	.15			
	44-66	.10	.10			
	66-76	.15	.15			
Green River Family	0-1	.15	.15	5	1	250
	1-11	.49	.49			
	11-22	.43	.43			
	22-71	.17	.17			
100:						
Mido Family, sodic	0-2	.15	.15	5	1	250
	2-4	.15	.15			
	4-11	.28	.28			
	11-18	.24	.24			
	18-41	.15	.15			
	41-76	.17	.17			

Table 23.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth Inches	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
101:						
Mido	0-3	.15	.15	5	1	250
	3-24	.15	.15			
	24-79	.32	.32			
102:						
Mido	0-2	.10	.10	5	1	250
	2-11	.15	.15			
	11-26	.15	.15			
	26-67	.15	.15			
	67-79	.15	.15			
103:						
Mido	0-4	.10	.10	5	1	250
	4-47	.10	.10			
	47-71	.15	.15			
Batterson	0-3	.24	.24	1	1	250
	3-6	.05	.17			
	6-7	---	---			
	7-17	---	---			
104:						
Mido	0-2	.10	.10	5	1	250
	2-24	.15	.15			
	24-70	.15	.15			
	70-79	.15	.15			
Begay	0-2	.37	.37	3	4L	86
	2-7	.49	.49			
	7-28	.49	.49			
	28-37	.49	.49			
	37-51	.28	.28			
	51-76	.28	.28			
105:						
Mido	0-8	.10	.10	5	1	250
	8-36	.10	.10			
	36-49	.15	.15			
	49-59	.05	.10			
Mido Family, frequently flooded	0-4	.05	.05	5	1	220
	4-22	.05	.05			
	22-39	.05	.05			
	39-71	.05	.05			
106:						
Monue	0-4	.55	.55	5	2	134
	4-31	.49	.49			
	31-60	.05	.10			

Table 23.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth Inches	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
106:						
Trail	0-3	.28	.28	5	2	134
	3-16	.28	.28			
	16-43	.24	.24			
	43-71	.28	.28			
Nepalto	0-4	.10	.10	5	1	220
	4-10	.02	.10			
	10-60	.02	.10			
107:						
Pensom	0-4	.15	.15	5	1	250
	4-20	.15	.15			
	20-35	.15	.15			
	35-41	.15	.15			
	41-51	---	---			
Mido	0-3	.15	.15	5	1	250
	3-16	.15	.15			
	16-27	.15	.15			
	27-79	.15	.15			
108:						
Reef	0-4	.05	.24	1	6	48
	4-5	---	---			
	5-15	---	---			
109:						
Reef	0-4	.15	.43	1	7	38
	4-13	---	---			
	13-23	---	---			
110:						
Rizno	0-2	.55	.55	1	1	310
	2-6	.55	.55			
	6-16	---	---			
Ignacio	0-3	.24	.24	2	3	86
	3-22	.24	.24			
	22-32	---	---			
111:						
Rizno	0-2	.15	.24	1	2	134
	2-4	.20	.28			
	4-6	---	---			
	6-15	---	---			
112:						
Rizno	0-1	.24	.24	1	3	86
	1-6	.28	.28			
	6-15	---	---			

Table 23.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth Inches	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
113:						
Arches	0-9	.24	.24	1	1	250
	9-19	.24	.24			
	19-29	---	---			
114:						
Arches	0-4	.32	.32	1	2	134
	4-8	.32	.32			
	8-18	---	---			
115:						
Nalcase	0-2	.15	.15	1	1	250
	2-6	.15	.15			
	6-9	---	---			
	9-19	---	---			
116:						
Needle	0-4	.24	.24	1	2	250
	4-11	.24	.24			
	11-21	---	---			
117:						
Torriorthents	0-2	.10	.24	1	6	48
	2-12	---	---			
118:						
Tsaya	0-4	.17	.43	1	1	160
	4-7	---	---			
	7-17	---	---			
119:						
Sazi	0-4	.28	.28	2	3	86
	4-11	.28	.28			
	11-28	.24	.24			
	28-30	---	---			
	30-43	---	---			
Rizno	0-3	.15	.24	1	2	134
	3-10	.28	.28			
	10-20	---	---			
120:						
Sheppard Family	0-4	.15	.15	2	1	250
	4-20	.24	.24			
	20-30	.32	.32			
	30-39	---	---			
Tsaya Family	0-3	.28	.28	1	3	86
	3-10	.10	.32			
	10-20	---	---			
Bluechief Family	0-4	.15	.24	2	5	56
	4-22	.15	.28			
	22-32	---	---			

Table 23.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth Inches	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
121:						
Torriorthents	0-4	.10	.24	2	6	48
	4-27	.10	.24			
	27-37	---	---			
122:						
Torriorthents	0-4	.24	.24	2	3	86
	4-16	.28	.28			
	16-33	.20	.37			
	33-43	---	---			
123:						
Tsaya Family	0-4	.28	.28	1	3	86
	4-9	.28	.28			
	9-16	.05	.28			
	16-26	---	---			
Moenkopie	0-2	.20	.20	1	2	134
	2-8	.17	.28			
	8-18	---	---			
124:						
Tsaya Family	0-2	.10	.24	1	6	48
	2-11	.05	.24			
	11-21	---	---			

Table 24.--Chemical Soil Properties

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
90:							
Arches---------------	0-1	0.8-5.3	7.4-8.4	0-3	0	0	0
	1-4	0.8-5.0	7.9-8.4	1-3	0	0	0
	4-9	0.8-5.0	7.9-8.4	1-5	0	0	0
	9-19	---	---	---	---	---	---
91:							
Arches, sand sheet---	0-4	1.4-6.8	7.9-8.4	0-5	0	0	0
	4-7	0.8-5.7	7.4-8.4	0-10	0	0	0
	7-10	---	---	---	---	---	---
	10-20	---	---	---	---	---	---
Mido-----------------	0-2	0.8-5.3	7.4-8.4	0-5	0	0	0
	2-23	0.8-4.2	7.4-8.4	0-5	0	0	0
	23-57	0.8-4.0	7.4-8.4	3-10	0	0	0
	57-60	0.8-4.0	7.9-9.0	3-10	0	0	0
	60-70	---	---	---	---	---	---
92:							
Begay, bedrock substratum----------	0-4	2.6-9.1	7.4-8.4	0-3	0	0	0
	4-6	3.3-13	7.9-8.4	0-5	0	0	0-2
	6-16	7.6-13	7.9-8.4	0-5	0	0	0-2
	16-31	7.6-13	7.9-9.0	2-10	0	0	0-2
	31-61	7.6-12	7.9-9.0	2-10	0	0	0-2
	61-71	---	---	---	---	---	---
Mido-----------------	0-4	0.8-4.5	7.4-8.4	0-2	0	0	0
	4-8	0.8-6.4	7.4-8.4	1-5	0	0	0
	8-51	0.8-4.0	7.9-8.4	1-5	0	0	0
	51-79	0.8-4.0	7.9-8.4	1-5	0	0	0
93:							
Begay----------------	0-4	4.1-9.1	7.4-8.4	0-2	0	0	0
	4-16	4.1-13	7.9-8.4	0-5	0	0	0
	16-59	6.2-13	7.9-8.4	5-10	0	0	0
	59-79	4.1-8.6	7.9-8.4	1-10	0	0	0
Ignacio--------------	0-4	2.6-13	7.4-8.4	0-2	0	0	0
	4-17	7.6-13	7.4-8.4	1-10	0	0	0
	17-22	4.1-13	7.9-9.0	5-15	0	0	0-2
	22-34	---	---	---	---	---	---
94:							
Bluechief------------	0-2	1.8-7.3	7.9-8.4	1-5	0	0	0
	2-7	4.1-8.9	7.9-8.4	1-5	0	0	0
	7-13	8.9-15	7.9-9.0	5-15	0	0	0-5
	13-34	8.9-15	7.9-9.0	15-35	0	0	0-5
	34-44	---	---	---	---	---	---

Table 24.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
94:							
Needle---------------	0-5	0.8-9.1	7.9-8.4	1-5	0	0	0
	5-15	---	---	---	---	---	---
95:							
Goblin---------------	0-3	1.9-7.6	7.9-8.4	1-5	20-40	2.0-8.0	0
	3-9	4.6-8.1	7.9-8.4	1-5	20-40	2.0-8.0	0
	9-19	---	---	---	---	---	---
96:							
Green River family---	0-4	8.9-16	7.9-8.4	5-20	0	0.0-2.0	0
	4-20	1.0-15	7.9-9.0	5-20	0	0.0-2.0	0-5
	20-79	1.0-15	7.9-9.0	5-20	0	0.0-2.0	0-5
Bebeevar-------------	0-3	3.1-15	7.9-8.4	5-20	0	0.0-2.0	0-2
	3-16	2.0-16	7.9-8.4	5-20	0	0.0-2.0	0-2
	16-43	2.0-16	7.9-8.4	5-20	0	0.0-2.0	0-2
	43-71	2.0-16	7.9-8.4	5-20	0	0.0-2.0	0-2
97:							
Mathis family--------	0-8	1.4-8.2	7.9-8.4	1-5	0	0.0-2.0	0-1
	8-71	1.4-7.4	7.9-8.4	1-5	0	0.0-2.0	0-1
Rizno----------------	0-1	4.1-9.1	7.9-8.4	1-5	0	0.0-4.0	0-1
	1-4	4.1-20	7.9-8.4	1-5	0	0.0-4.0	0-1
	4-14	---	---	---	---	---	---
98:							
Mellenthin-----------	0-4	4.1-13	7.9-8.4	5-15	0	0	0
	4-12	7.6-15	7.9-8.4	15-50	0	0	0
	12-16	7.6-15	7.9-8.4	15-50	0	0	0
	16-26	---	---	---	---	---	---
Wayneco family-------	0-2	6.2-16	7.9-8.4	5-15	0	0	0
	2-6	6.2-15	7.9-8.4	5-20	0	0	0
	6-10	7.6-15	7.9-9.0	15-50	0	0	0-2
	10-15	7.6-15	7.9-9.0	15-50	0	0	0-2
	15-17	---	---	---	---	---	---
	17-27	---	---	---	---	---	---
99:							
Mido family, occasionally flooded	0-3	0.8-4.5	7.9-8.4	0-5	0	0.0-2.0	0-2
	3-12	0.8-6.4	7.9-8.4	0-5	0	0.0-2.0	0-2
	12-18	0.8-6.1	7.9-8.4	0-5	0	0.0-2.0	0-2
	18-44	0.8-6.1	7.9-8.4	0-5	0	0.0-2.0	0-2
	44-66	0.8-6.1	7.9-8.4	0-5	0	0.0-2.0	0-2
	66-76	0.8-6.1	7.9-8.4	0-5	0	0.0-4.0	0-2
Green River family---	0-1	1.0-7.5	7.9-8.4	1-5	0	0.0-2.0	0-1
	1-11	1.0-15	7.9-9.0	1-5	0	0.0-2.0	0-1
	11-22	1.0-15	7.9-9.0	1-5	0	0.0-2.0	0-1
	22-71	1.0-7.1	7.9-9.0	1-5	0	0.0-2.0	0-1

Table 24.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
100:							
Mido family, sodic---	0-2	2.0-8.2	7.9-8.4	1-5	0	0.0-4.0	0-5
	2-4	2.0-8.2	7.9-9.0	1-5	0	0.0-4.0	0-20
	4-11	3.1-11	7.9-9.5	1-5	0	0.0-4.0	0-20
	11-18	3.1-11	7.9-9.5	1-5	0	0.0-4.0	0-20
	18-41	2.0-6.1	7.9-9.0	1-5	0	4.0-8.0	0-20
	41-76	1.4-11	7.9-9.5	1-5	0	4.0-8.0	0-20
101:							
Mido-----------------	0-3	1.4-5.3	7.9-8.4	1-5	0	0.0-2.0	0
	3-24	1.4-4.7	7.9-8.4	1-5	0	0.0-2.0	0
	24-79	1.4-4.7	7.9-8.4	1-10	0	0.0-2.0	0
102:							
Mido-----------------	0-2	0.8-4.5	7.9-8.4	0-5	0	0	0
	2-11	0.0-4.2	7.9-9.0	0-5	0	0	0
	11-26	0.0-4.0	7.9-9.0	0-5	0	0.0-2.0	0-2
	26-67	0.0-4.0	7.9-9.0	0-5	0	0.0-2.0	0-2
	67-79	0.0-4.0	7.9-9.0	0-5	0	0.0-2.0	0-2
103:							
Mido-----------------	0-4	0.8-8.2	7.9-8.4	1-5	0	0	0
	4-47	0.8-7.4	7.9-9.0	1-5	0	0	0-5
	47-71	0.8-4.7	7.9-9.0	1-5	0	0	0-5
Batterson------------	0-3	0.8-4.5	7.9-8.4	1-5	0	0	0
	3-6	0.8-7.4	7.4-8.4	5-20	0	0	0
	6-7	---	---	---	---	---	---
	7-17	---	---	---	---	---	---
104:							
Mido-----------------	0-2	0.8-2.9	7.9-8.4	1-5	0	0.0-2.0	0-1
	2-24	0.8-6.4	7.9-9.0	1-5	0	0.0-2.0	0-1
	24-70	0.8-6.1	7.9-9.0	1-5	0	0.0-2.0	0-1
	70-79	0.8-6.1	7.9-9.0	1-5	0	0.0-2.0	0-1
Begay----------------	0-2	4.1-16	7.9-8.4	1-5	0	0.0-2.0	0-1
	2-7	4.1-15	7.9-8.4	1-5	0	0.0-2.0	0-1
	7-28	4.1-15	7.9-9.0	1-5	0	0.0-2.0	0-1
	28-37	4.1-15	7.9-9.0	1-5	0	0.0-2.0	0-1
	37-51	4.1-15	7.9-9.0	1-5	0	0.0-2.0	0-1
	51-76	4.1-15	7.9-9.0	1-5	0	0.0-2.0	0-1
105:							
Mido-----------------	0-8	0.8-4.5	7.4-8.4	1-5	0	0	0
	8-36	0.8-4.2	7.9-8.4	1-5	0	0	0
	36-49	0.8-4.0	7.9-8.4	1-5	0	0	0
	49-59	0.8-4.0	7.9-8.4	1-5	0	0	0
Mido family, frequently flooded--	0-4	0.8-4.5	7.9-8.4	1-5	0	0	0
	4-22	0.8-4.2	7.9-8.4	1-5	0	0	0
	22-39	0.8-4.0	7.9-8.4	1-5	0	0	0
	39-71	0.8-4.0	7.9-8.4	1-5	0	0	0

Table 24.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
106:							
Monue----------------	0-4	4.1-10	7.9-8.4	5-10	0	0.0-8.0	0-20
	4-31	7.6-12	7.9-8.4	10-15	0	0.0-8.0	0-20
	31-60	1.0-8.6	7.9-8.4	10-20	0	0.0-8.0	0-20
Trail----------------	0-3	3.1-7.8	7.9-8.4	1-5	0	0.0-2.0	0
	3-16	3.1-7.8	7.9-8.4	1-5	0	0.0-2.0	0
	16-43	0.8-7.4	7.9-8.4	1-5	0	0.0-2.0	0
	43-71	0.8-7.4	7.9-8.4	1-5	0	0.0-2.0	0
Nepalto--------------	0-4	1.4-6.4	7.9-8.4	5-10	0	0.0-2.0	0
	4-10	1.4-6.1	7.9-8.4	5-10	0	0.0-2.0	0
	10-60	1.4-6.1	7.9-8.4	5-10	0	0.0-2.0	0
107:							
Pensom---------------	0-4	0.8-4.2	7.4-8.4	0-2	0	0	0
	4-20	0.8-5.4	7.4-8.4	0-5	0	0	0
	20-35	0.8-5.4	7.4-8.4	0-5	0	0	0
	35-41	0.8-5.4	7.4-8.4	0-5	0	0	0
	41-51	---	---	---	---	---	---
Mido-----------------	0-3	0.8-4.2	7.4-8.4	0-2	0	0	0
	3-16	0.8-5.4	7.9-8.4	0-5	0	0	0
	16-27	0.8-5.4	7.9-8.4	0-5	0	0	0
	27-79	0.8-5.4	7.9-8.4	0-5	0	0	0
108:							
Reef-----------------	0-4	6.9-12	7.9-9.0	10-40	0	0	0-5
	4-5	---	---	---	---	---	---
	5-15	---	---	---	---	---	---
109:							
Reef-----------------	0-4	6.2-16	7.9-8.4	1-5	0	0	0
	4-13	---	---	---	---	---	---
	13-23	---	---	---	---	---	---
110:							
Rizno----------------	0-2	3.3-9.1	7.9-8.4	1-5	0	0	0
	2-6	4.1-13	7.9-8.4	1-5	0	0	0
	6-16	---	---	---	---	---	---
Ignacio--------------	0-3	4.8-16	7.9-8.4	1-5	0	0	0
	3-22	7.6-15	7.9-9.0	1-5	0	0	0-5
	22-32	---	---	---	---	---	---
111:							
Rizno----------------	0-2	6.2-13	7.9-8.4	1-5	0	0	0
	2-4	7.6-15	7.9-8.4	5-15	0	0	0
	4-6	---	---	---	---	---	---
	6-15	---	---	---	---	---	---
112:							
Rizno----------------	0-1	6.2-11	7.9-8.4	1-5	0	0	0
	1-6	7.6-12	7.9-8.4	3-5	0	0	0
	6-15	---	---	---	---	---	---

Table 24.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
113:							
Arches---------------	0-9	0.0-5.3	7.9-8.4	0-1	0	0	0
	9-19	0.0-6.4	7.9-9.0	0-5	0	0	0-5
	19-29	---	---	---	---	---	---
114:							
Arches---------------	0-4	1.4-5.3	7.9-8.4	1-3	0	0.0-2.0	0
	4-8	1.4-7.8	7.9-9.0	2-5	0	0.0-2.0	0-5
	8-18	---	---	---	---	---	---
115:							
Nalcase--------------	0-2	0.8-2.7	7.4-7.8	0-1	0	0	0
	2-6	0.8-2.6	7.4-7.8	0-1	0	0	0
	6-9	---	---	---	---	---	---
	9-19	---	---	---	---	---	---
116:							
Needle---------------	0-4	0.8-2.7	7.9-8.4	1-5	0	0.0-2.0	0
	4-11	0.8-2.6	7.9-8.4	1-5	0	0.0-2.0	0
	11-21	---	---	---	---	---	---
117:							
Torriorthents--------	0-2	1.4-14	7.4-7.8	0-5	0	0	0
	2-12	---	---	---	---	---	---
118:							
Tsaya----------------	0-4	7.6-20	7.9-8.4	5-10	0	0.0-4.0	0-2
	4-7	---	---	---	---	---	---
	7-17	---	---	---	---	---	---
119:							
Sazi-----------------	0-4	1.0-9.1	7.9-8.4	5-10	0	0	0
	4-11	1.0-8.9	7.9-9.0	5-15	0	0	0-5
	11-28	4.1-13	7.9-9.0	10-35	0	0	0-5
	28-30	---	---	---	---	---	---
	30-43	---	---	---	---	---	---
Rizno----------------	0-3	1.4-12	7.9-8.4	1-5	0	0	0
	3-10	5.6-11	7.9-9.0	1-5	0	0	0-5
	10-20	---	---	---	---	---	---
120:							
Sheppard family------	0-4	0.8-4.5	7.9-8.4	1-5	0	0.0-2.0	0
	4-20	1.4-7.4	7.9-8.4	5-10	0	0.0-2.0	0
	20-30	1.4-7.4	7.9-8.4	5-10	0	0.0-2.0	0
	30-39	---	---	---	---	---	---
Tsaya family---------	0-3	6.2-13	7.9-8.4	5-15	0-3	0.0-2.0	0
	3-10	6.2-12	7.9-8.4	5-15	0-3	0.0-2.0	0
	10-20	---	---	---	---	---	---
Bluechief family-----	0-4	6.2-13	7.9-8.4	5-10	1-4	0.0-2.0	0
	4-22	7.6-13	7.9-8.4	10-15	1-4	0.0-2.0	0
	22-32	---	---	---	---	---	---

Table 24.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
121:							
Torriorthents--------	0-4	5.7-13	7.4-8.4	1-5	0	0.0-2.0	0
	4-27	5.7-22	7.9-8.4	1-15	0	0.0-2.0	0
	27-37	---	---	---	---	---	---
122:							
Torriorthents--------	0-4	3.1-11	7.9-8.4	5-15	0	0.0-2.0	0-5
	4-16	5.7-22	7.9-9.0	10-25	0	0.0-2.0	0-5
	16-33	5.7-21	7.9-9.0	10-25	0	0.0-2.0	0-5
	33-43	---	---	---	---	---	---
123:							
Tsaya family---------	0-4	6.2-15	7.9-8.4	0-5	0	0.0-4.0	0-2
	4-9	7.6-16	7.9-8.4	1-5	0	0.0-4.0	0-2
	9-16	7.6-16	7.9-8.4	1-5	0	0.0-4.0	0-2
	16-26	---	---	---	---	---	---
Moenkopie------------	0-2	7.6-15	7.9-8.4	1-10	0	0.0-4.0	0-2
	2-8	7.6-15	7.9-8.4	1-10	0	0.0-4.0	0-2
	8-18	---	---	---	---	---	---
124:							
Tsaya family---------	0-2	6.2-15	7.9-9.0	1-5	0-5	0.0-4.0	0-2
	2-11	7.6-16	7.9-9.0	1-5	0-5	0.0-4.0	0-2
	11-21	---	---	---	---	---	---

Table 25.--Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Frequency	Flooding: Frequency
			Ft	Ft		
90:						
Arches	D					
		Jan-Dec	---	---	None	None
91:						
Arches, sand sheet	D					
		Jan-Dec	---	---	None	None
Mido	A					
		Jan-Dec	---	---	None	None
92:						
Begay, bedrock substratum	A					
		Jan-Dec	---	---	None	None
Mido	A					
		Jan-Dec	---	---	None	None
93:						
Begay	A					
		Jan-Dec	---	---	None	None
Ignacio	C					
		Jan-Dec	---	---	None	None
94:						
Bluechief	B					
		Jan-Dec	---	---	None	None
Needle	D					
		Jan-Dec	---	---	None	None
95:						
Goblin	D					
		Jan-Dec	---	---	None	None
96:						
Green River Family	B/D					
		July	0.2-1.1	---	None	Occasional
		August	0.2-1.1	---	None	Occasional
		September	0.2-1.1	---	None	Occasional
		October	0.2-1.1	---	None	Occasional
Bebeevar	A/D					
		July	0.7-1.3	---	None	Rare
		August	0.7-1.3	---	None	Rare
		September	0.7-1.3	---	None	Rare
		October	0.7-1.3	---	None	Rare
97:						
Mathis Family	A					
		Jan-Dec	---	---	None	None
Rizno	D					
		Jan-Dec	---	---	None	None

Table 25.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table Upper limit	Water table Lower limit	Ponding Frequency	Flooding Frequency
			Ft	Ft		
98:						
Mellenthin	D					
		Jan-Dec	---	---	None	None
Wayneco Family	D					
		Jan-Dec	---	---	None	None
99:						
Mido Family, occasionally flooded	A					
		July	---	---	None	Occasional
		August	---	---	None	Occasional
		September	---	---	None	Occasional
		October	---	---	None	Occasional
Green River Family	A/D					
		July	1.6-3.3	---	None	Frequent
		August	1.6-3.3	---	None	Frequent
		September	1.6-3.3	---	None	Frequent
		October	1.6-3.3	---	None	Frequent
		November	1.6-2.1	---	None	None
100:						
Mido Family, sodic	A					
		July	---	---	None	Very rare
		August	---	---	None	Very rare
		September	---	---	None	Very rare
		October	---	---	None	Very rare
		November	---	---	None	Very rare
101:						
Mido	A					
		Jan-Dec	---	---	None	None
102:						
Mido	A					
		Jan-Dec	---	---	None	None
103:						
Mido	A					
		Jan-Dec	---	---	None	None
Batterson	D					
		Jan-Dec	---	---	None	None
104:						
Mido	A					
		Jan-Dec	---	---	None	None
Begay	A					
		Jan-Dec	---	---	None	None

Table 25.-- Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Frequency	Flooding: Frequency
			Ft	Ft		
105:						
Mido-------------------------------	A					
		July	---	---	None	Rare
		August	---	---	None	Rare
		September	---	---	None	Rare
Mido Family, frequently flooded----	A					
		July	---	---	None	Frequent
		August	---	---	None	Frequent
		September	---	---	None	Frequent
106:						
Monue------------------------------	A					
		July	---	---	None	Rare
		August	---	---	None	Rare
		September	---	---	None	Rare
		October	---	---	None	Rare
Trail------------------------------	A					
		July	---	---	None	Rare
		August	---	---	None	Rare
		September	---	---	None	Rare
		October	---	---	None	Rare
Nepalto----------------------------	A					
		July	---	---	None	Very rare
		August	---	---	None	Very rare
		September	---	---	None	Very rare
		October	---	---	None	Very rare
107:						
Pensom-----------------------------	A					
		Jan-Dec	---	---	None	None
Mido-------------------------------	A					
		Jan-Dec	---	---	None	None
108:						
Reef-------------------------------	D					
		Jan-Dec	---	---	None	None
109:						
Reef-------------------------------	D					
		Jan-Dec	---	---	None	None

Table 25.-- Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Frequency	Flooding: Frequency
			Ft	Ft		
110:						
Rizno	D					
		Jan-Dec	---	---	None	None
Ignacio	C					
		Jan-Dec	---	---	None	None
111:						
Rizno	D					
		Jan-Dec	---	---	None	None
112:						
Rizno	D					
		Jan-Dec	---	---	None	None
113:						
Arches	D					
		Jan-Dec	---	---	None	None
114:						
Arches	D					
		Jan-Dec	---	---	None	None
115:						
Nalcase	D					
		Jan-Dec	---	---	None	None
116:						
Needle	D					
		Jan-Dec	---	---	None	None
117:						
Torriorthents	D					
		Jan-Dec	---	---	None	None
118:						
Tsaya	D					
		Jan-Dec	---	---	None	None
119:						
Sazi	B					
		Jan-Dec	---	---	None	None
Rizno	D					
		Jan-Dec	---	---	None	None
120:						
Sheppard Family	A					
		Jan-Dec	---	---	None	None
Tsaya Family	D					
		Jan-Dec	---	---	None	None
Bluechief Family	C					
		Jan-Dec	---	---	None	None

Table 25.-- Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Frequency	Flooding: Frequency
			Ft	Ft		
121:						
Torriorthents	B					
		Jan-Dec	---	---	None	None
122:						
Torriorthents	B					
		Jan-Dec	---	---	None	None
123:						
Tsaya Family	D					
		Jan-Dec	---	---	None	None
Moenkopie	D					
		Jan-Dec	---	---	None	None
124:						
Tsaya Family	D					
		Jan-Dec	---	---	None	None

Table 26.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that data were not populated. no data in all columns will not display.)

Map symbol and soil name	Restrictive layer				Potential for frost action	Ris
	Kind	Depth to top	Thickness	Hardness		Uncoa stee
		In	In			
90:						
Arches	Lithic bedrock	4-20	---	Indurated	Low	Low
91:						
Arches, sand sheet	Lithic bedrock	4-20	---	Indurated	Low	Low
	Paralithic bedrock	4-17		Moderately cemented		
Mido	Paralithic bedrock	60-80	---	Moderately cemented	Low	Low
92:						
Begay, bedrock substratum	Lithic bedrock	60-80	---	Indurated	Moderate	Low
Mido	No restriction	---	---	---	Low	Low
93:						
Begay	No restriction	---	---	---	Moderate	Low
Ignacio	Lithic bedrock	20-40	---	Indurated	Moderate	Low
94:						
Bluechief	Lithic bedrock	20-40	---	Indurated	Moderate	Low
Needle	Lithic bedrock	5-20	---	Indurated	Low	Low
95:						
Goblin	Lithic bedrock	6-16	---	Indurated	Moderate	Moder
96:						
Green River Family	No restriction	---	---	---	Low	Hig
Bebeevar	No restriction	---	---	---	Low	Low
97:						
Mathis Family	Lithic bedrock	20-80	---	Indurated	Low	Low
Rizno	Lithic bedrock	4-20	---	Indurated	Low	Moder

Table 26.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Ris
	Kind	Depth to top	Thickness	Hardness		Uncoa stee
		In	In			
98:						
Mellenthin	Lithic bedrock	4-20	---	Indurated	Moderate	Moder
Wayneco Family	Paralithic bedrock	0-16	---	Moderately cemented	Moderate	Moder
	Lithic bedrock	4-20		Indurated		
99:						
Mido Family, occasionally flooded	No restriction	---	---	---	Low	Low
Green River Family	No restriction	---	---	---	Low	Low
100:						
Mido Family, sodic	No restriction	---	---	---	Low	Low
101:						
Mido	No restriction	---	---	---	Low	Low
102:						
Mido	No restriction	---	---	---	Low	Low
103:						
Mido	No restriction	---	---	---	Low	Low
Batterson	Paralithic bedrock	4-17	---	Moderately cemented	Low	Low
	Lithic bedrock	4-20		Indurated		
104:						
Mido	No restriction	---	---	---	Low	Low
Begay	No restriction	---	---	---	Low	Low
105:						
Mido	No restriction	---	---	---	Low	Low
Mido Family, frequently flooded	No restriction	---	---	---	Low	Low

Table 26.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Ris
	Kind	Depth to top	Thickness	Hardness		Uncoa stee
		In	In			
106:						
Monue	No restriction	---	---	---	Moderate	Low
Trail	No restriction	---	---	---	Low	Low
Nepalto	No restriction	---	---	---	Low	Low
107:						
Pensom	Lithic bedrock	20-80	---	Indurated	Low	Low
Mido	No restriction	---	---	---	Low	Low
108:						
Reef	Paralithic bedrock	4-17	0-3	Moderately cemented	Moderate	Moder
	Lithic bedrock	4-20		Indurated		
109:						
Reef	Lithic bedrock	4-20	---	Indurated	Moderate	Moder
110:						
Rizno	Lithic bedrock	4-20	---	Indurated	Moderate	Moder
Ignacio	Lithic bedrock	20-40	---	Indurated	Moderate	Low
111:						
Rizno	Paralithic bedrock	4-17	---	Moderately cemented	Low	Low
	Lithic bedrock	5-20		Indurated		
112:						
Rizno	Lithic bedrock	4-20	---	Indurated	Moderate	Moder
113:						
Arches	Lithic bedrock	4-20	---	Indurated	Low	Low
114:						
Arches	Lithic bedrock	4-20	---	Indurated	Low	Low

Table 26.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Ris
	Kind	Depth to top	Thickness	Hardness		Uncoa stee
		In	In			
115:						
Nalcase	Paralithic bedrock	6-17	---	Moderately cemented	Low	Low
	Lithic bedrock	9-20		Indurated		
116:						
Needle	Lithic bedrock	4-20	---	Indurated	Low	Low
117:						
Torriorthents	Lithic bedrock	2-50	---	Indurated	Moderate	Low
118:						
Tsaya	Paralithic bedrock	4-17	---	Moderately cemented	Low	Low
	Lithic bedrock	7-20		Indurated		
119:						
Sazi	Lithic bedrock	20-40	0-3	Indurated	Moderate	Low
	Paralithic bedrock	20-37		Moderately cemented		
Rizno	Lithic bedrock	4-20	---	Indurated	Low	Low
120:						
Sheppard Family	Lithic bedrock	20-40	---	Indurated	Low	Low
Tsaya Family	Lithic bedrock	4-20	---	Indurated	Moderate	Moder
Bluechief Family	Lithic bedrock	20-40	---	Indurated	Moderate	Low
121:						
Torriorthents	Lithic bedrock	4-80	---	Indurated	Moderate	Low
122:						
Torriorthents	Lithic bedrock	4-40	---	Indurated	Low	Low

Table 26.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Ris
	Kind	Depth to top	Thickness	Hardness		Uncoa stee
		In	In			
123:						
Tsaya Family	Lithic bedrock	10-20	---	Indurated	Moderate	Moder
Moenkopie	Lithic bedrock	8-20	---	Indurated	Moderate	Low
124:						
Tsaya Family	Lithic bedrock	4-20	---	Indurated	Low	Moder

Table 27.--Landscape, Parent Material and Ecosite ID

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
90:								
Arches-------------	65	2-15	4836-6325	9-13	Mesa	Navajo Formation Sandstone (Jurassic)	Eolian sands derived from sandstone	Semideser Loam (Ut Blackbru
91:								
Arches, sand sheet-	30	2-6	4363-6857	9-13	Structural bench	Eolian Sand (Quaternary), Cedar Mesa and White Rim Formation Sandstones (Permian)	Eolian sands	Semideser Loam (Ut Blackbru
Mido---------------	30	5-15	4363-6857	9-13	Dune on structural bench	Sand Deposits (Quaternary)	Eolian sands	Semideser (Blackbr R035XY21
92:								
Begay, bedrock substratum--------	50	2-6	4918-6371	9-13	Sand sheet on mesa Sand sheet on structural bench	Eolian sand and slope alluvium (Quaternary)	Slope alluvium derived from sandstone and/or eolian sands over residuum weathered from sandstone	Semideser (Fourwin R035XY21
Mido---------------	40	2-6	4918-6371	9-13	Sand sheet on mesa	Eolian sand and slope alluvium (Quaternary)	Slope alluvium derived from sandstone and/or eolian sands derived from sandstone	Semideser Saltbush

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
93:								
Begay-------------	50	2-10	5000-6247	9-13	Sand sheet on mesa	Eolian sand and slope alluvium (Quaternary)	Eolian deposits derived from sandstone and/or slope alluvium derived from sandstone	Semideser (Fourwin R035XY21
Ignacio-----------	30	2-8	5000-6247	9-13	Sand sheet on mesa	Eolian sand and slope alluvium (Quaternary)	Eolian deposits derived from sandstone and/or slope alluvium derived from sandstone	Semideser (Fourwin R035XY21
94:								
Bluechief---------	45	2-8	3980-5246	5-9	Structural bench	Eolian Sand (Quaternary) and White Rim Formation Sandstone (Permian)	Eolian deposits derived from sandstone and/or residuum weathered from sandstone	Desert Sa (Blackbr R035XY12
Needle------------	40	2-15	3980-5246	5-9	Structural bench	Eolian Sand (Quaternary) and White Rim Formation Sandstone (Permian)	Eolian sands derived from sandstone	Desert Sh (Blackbr R035XY13
95:								
Goblin------------	90	6-45	3983-5207	5-9	Hill	Moenkopie Formation Sandstone, Shnabkaib Member (Triassic)	Gypsiferous residuum weathered from sandstone	Desert Ve Gypsum (Jointfir

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
96:								
Green River family-	75	0-6	3789-4291	5-9	Low flood-plain step	Alluvium (Quaternary)	Alluvium derived from mixed	Semiwet F (Fremont R035XY01
Bebeevar-----------	20	0-6	3789-4291	5-9	Intermediate flood-plain step	Alluvium (Quaternary)	Alluvium derived from sandstone	Sandy Bot Saltbush
97:								
Mathis family------	45	30-70	4118-6401	9-13	Talus slope	Wingate and Kayenta Formation Sandstones over Chinle Formation (Jurassic)	Colluvium derived from sandstone	Semideser Stony Lo Juniper)
Rizno--------------	15	15-30	4311-6401	9-13	Ledge	Kayenta Formation Sandstone (Triassic)	Colluvium derived from sandstone and/or residuum weathered from sandstone	Semideser Loam (Ut Blackbru
					Structural bench			
98:								
Mellenthin---------	50	1-4	5066-6302	9-13	Mesa	Navajo Formation Sandstone (Jurassic)	Residuum weathered from sandstone	Semideser Loam (Bl R035XY23
Wayneco family-----	35	2-6	5066-6302	9-13	Mesa	Navajo Formation Sandstone (Jurassic)	Residuum weathered from calcareous sandstone	Semideser Loam (Bl R035XY23

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
99:								
Mido family, occasionally flooded----------	70	1-6	4632-6227	9-13	Intermediate flood-plain step	Alluvium (Quaternary)	Alluvium derived from sandstone	Loamy Bot Sagebrus
Green River family-	15	0-1	4632-6227	9-13	Low flood- plain step	Alluvium (Quaternary)	Alluvium derived from sandstone	Semiwet F (Fremont R035XY01
100:								
Mido family, sodic-	70	0-8	4587-4974	9-13	Stream terrace	Alluvium (Quaternary)	Alluvium derived from sandstone	Alkali Bo (Greasew R035XY00
101:								
Mido---------------	90	0-6	4373-5925	9-13	Graben	Eolian sand and slope alluvium (Quaternary)	Slope alluvium derived from sandstone and/or eolian sands derived from sandstone	Semideser Saltbush
102:								
Mido---------------	95	2-15	4888-6165	9-13	Mesa	Eolian sand and slope alluvium (Quaternary)	Slope alluvium derived from sandstone and/or eolian sands derived from sandstone	Semideser (Blackbr R035XY21
					Upper valley side			
103:								
Mido---------------	35	2-15	4580-6653	9-13	Dune on mesa	Eolian sand and slope alluvium (Quaternary)	Alluvium derived from sandstone and/or eolian sands	Semideser (Blackbr R035XY21
					Dune on structural bench			

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
103:								
Batterson----------	30	2-15	4580-6653	9-13	Mesa Structural bench	Cedar Mesa Formation Sandstone (Permian)	Residuum weathered from sandstone and/or eolian sands	Semideser Loam (Ut Blackbru
104:								
Mido---------------	65	2-6	4823-6145	9-13	Valley side	Eolian sand and slope alluvium (Quaternary)	Eolian deposits derived from sandstone and/or slope alluvium derived from sandstone	Semideser Saltbush
Begay--------------	30	0-2	4823-6145	9-13	Valley floor	Eolian sand and slope alluvium (Quaternary)	Alluvium derived from sandstone and/or slope alluvium derived from sandstone	Semideser (Fourwin R035XY21
105:								
Mido---------------	65	2-15	4176-5180	9-13	Dunes on terrace	Alluvium and eolan sands (Quaternary)	Alluvium derived from sandstone Eolian sands	Semideser Saltbush
Mido family, frequently flooded	15	1-10	4176-5180	9-13	Flood-plain step	Alluvium (Quaternary)	Alluvium derived from sandstone	Semiwet F (Fremont R035XY01
106:								
Monue--------------	30	1-6	3829-4764	5-9	Stream terrace	Alluvium (Quaternary)	Alluvium derived from sandstone	Alkali Bo (Greasew R035XY00
Trail--------------	30	1-6	3829-4764	5-9	Alluvial flat	Alluvium (Quaternary)	Alluvium derived from sandstone and/or slope alluvium derived from sandstone	Desert Sa (Fourwin R035XY11

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
106:								
Nepalto------------	25	1-6	3829-4764	5-9	Alluvial flat	Alluvium (Quaternary)	Slope alluvium derived from sandstone	Desert St (Shadsca Sagebrus
107:								
Pensom-------------	45	2-15	4842-6293	9-13	Dunes on mesa Sandsheets on mesa	Eolian sand and dune sand (Quaternary)	Eolian sands derived from sandstone	Semideser Saltbush
Mido---------------	40	2-30	4842-6293	9-13	Dunes on mesa Sandsheets on mesa	Eolian sand and dune sand (Quaternary)	Eolian sands derived from sandstone	Semideser Saltbush
108:								
Reef---------------	60	2-30	5121-6742	9-13	Mesa Structural bench	Organ Rock Shale (Permian) and Moenkopie Formation Sandstone (Triassic)	Residuum weathered from sandstone and shale	Semideser Gravelly Juniper)
109:								
Reef---------------	65	30-60	4482-7188	9-13	Talus slope	Organ Rock Shale (Permian) and Moenkopie Formation Sandstone (Triassic)	Colluvium derived from sandstone	Semideser Stony Lo Juniper)

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
110:								
Rizno--------------	50	2-15	4626-5525	9-13	Mesa	Cedar Mesa Formation Sandstone (Permian)	Eolian deposits derived from sandstone	Semideser Loam (Ut Blackbru
Ignacio------------	35	2-15	4626-5525	9-13	Mesa	Eolian sand and slope alluvium (Quaternary)	Eolian deposits derived from sandstone	Semideser (Fourwin R035XY21
111:								
Rizno--------------	60	1-25	4514-6404	9-13	Mesa Structural bench	Kayenta Formation Sandstone (Triassic)	Residuum weathered from sandstone	Semideser Loam (Ut Blackbru
112:								
Rizno--------------	40	2-15	5154-6991	9-13	Mesa	Eolian Sand (Quaternary) and Shinarump Conglomerate Member of Chinle Formation (Triassic)	Eolian deposits derived from sandstone	Semideser Loam (Ut Blackbru
113:								
Arches-------------	25	2-15	4245-6653	9-13	Mesa Structural bench	Cedar Mesa Formation Sandstone (Permian)	Eolian sands	Shallow S (Utah Ju R035XY01

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
114:								
Arches-------------	15	2-60	4295-6837	9-13	Butte	Eolian Sand (Quaternary) and Cedar Mesa Formation Sandstone (Permian)	Eolian sands derived from sandstone	Shallow S (Utah Ju R035XY01
					Mesa			
					Structural bench			
115:								
Nalcase------------	25	2-15	4701-6329	9-13	Butte	Navajo Formation Sandstone (Jurassic)	Eolian sands derived from sandstone	Shallow S (Utah Ju R035XY01
					Mesa			
116:								
Needle-------------	35	2-30	3927-5279	5-9	Structural bench	Eolian Sand (Quaternary) and White Rim Formation Sandstone (Permian)	Eolian sands derived from sandstone	Shallow S (Utah Ju R035XY01
117:								
Torriorthents------	45	20-65	3914-5236	5-9	Talus slope	Organ Rock Shale and Cedar Mesa Formation Sandstone (Permian)	Colluvium derived from sandstone	Desert Ve Loam (Sh R035XY14
118:								
Tsaya--------------	45	15-60	3898-5604	5-9	Structural bench	Moenkopie Formation (Triassic) and Cutler Group (Permian) Sandstones	Colluvium derived from sandstone and/or residuum weathered from sandstone	Desert Ve Loam (Sh R035XY14
					Talus slope			

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
119:								
Sazi---------------	50	2-15	4514-6263	9-13	Mesa Structural bench	Eolian Sand (Quaternary)	Eolian deposits	Semideser (Blackbr R035XY21
Rizno--------------	30	2-6	4514-6263	9-13	Mesa Structural bench	Eolian Sand (Quaternary) and Sandstone Formations (Permian and Triassic)	Eolian deposits and/or residuum weathered from sandstone	Semideser Loam (Bl R035XY23
120:								
Sheppard family----	30	2-15	3976-5216	5-9	Structural bench	Eolian Sand (Quaternary)	Eolian sands derived from sandstone	Desert Sa (Blackbr R035XY12
Tsaya family-------	30	2-15	3976-5216	5-9	Structural bench	Moenkopie Formation Sandstone (Triassic)	Residuum weathered from sandstone	Desert Sh (Blackbr R035XY13
Bluechief family---	20	2-8	3976-5216	5-9	Structural bench	Eolian Sand (Quaternary) and Moenkopie Formation Sandstone (Triassic)	Residuum weathered from sandstone	Desert Sa (Blackbr R035XY12
121:								
Torriorthents------	45	4-70	4039-6404	5-9	Hill Scarp slope	Wingate and Chinle Formations (Triassic)	Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale	Desert Ve Loam (Sh R035XY14

Table 27.--Landscape, Parent Material and Ecosite ID--Continued

Map symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landform	Geology	Parent material	Ec
	Pct	Pct	Ft	In				
122:								
Torriorthents------	50	35-70	3740-5574	5-9	Scarp slope	Halgaito Shale, Honaker Trail, and Paradox Formations (Pennsylvanian)	Colluvium derived from arenaceous limestone	Desert Ve Loam (Sh R035XY14
123:								
Tsaya family-------	50	2-15	3911-5371	5-9	Structural bench	Moenkopie Formation (Triassic) and Cutler Group (Permian) Sandstones	Residuum weathered from sandstone and/or slope alluvium derived from sandstone	Desert Sh (Shadsca
Moenkopie----------	40	2-15	3911-5371	5-9	Structural bench	Moenkopie Formation (Triassic) and Cutler Group (Permian) Sandstones	Residuum weathered from sandstone and/or slope alluvium derived from sandstone	Desert Sh (Shadsca
124:								
Tsaya family-------	65	35-80	4508-5335	5-9	Hill	Moenkopie and Chinle Formations (Triassic)	Residuum weathered from sandstone	Desert Ve Loam (Sh R035XY14

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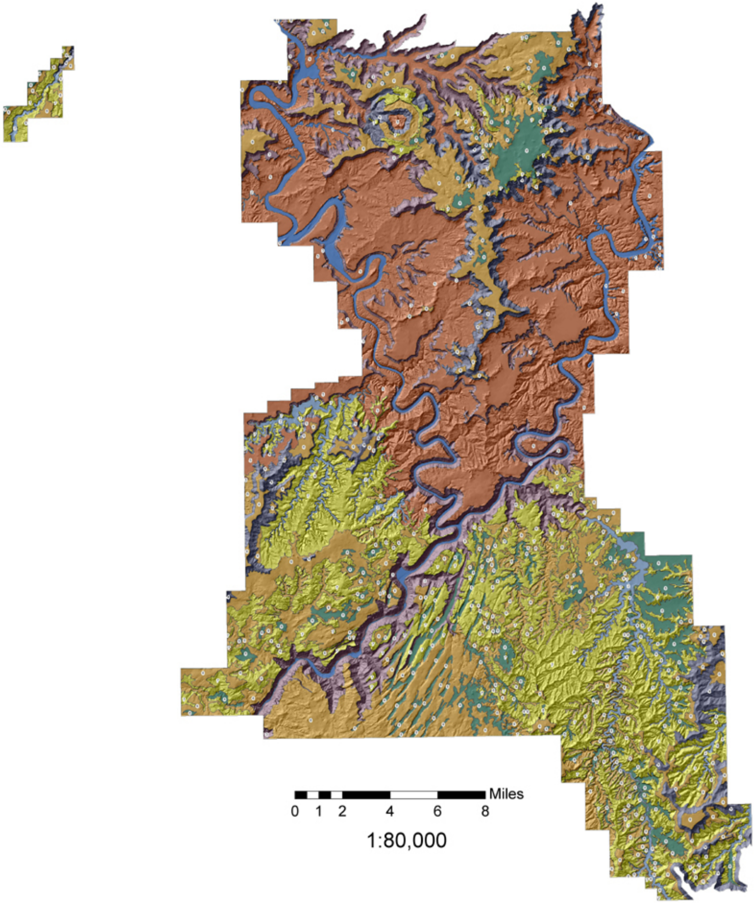
GENERAL SOIL MAP

Canyonlands National Park, Utah



Legend

Alluvial soils on flood plains, terraces, and alluvial flats

- 1 - Water-Green River-Trail association, nearly level to gently sloping, arid
- 2 - Mido family-Mido-Green River family association, nearly level to strongly sloping, semiarid

Colluvial soils on talus slopes, scarp slopes, ledges, and hills

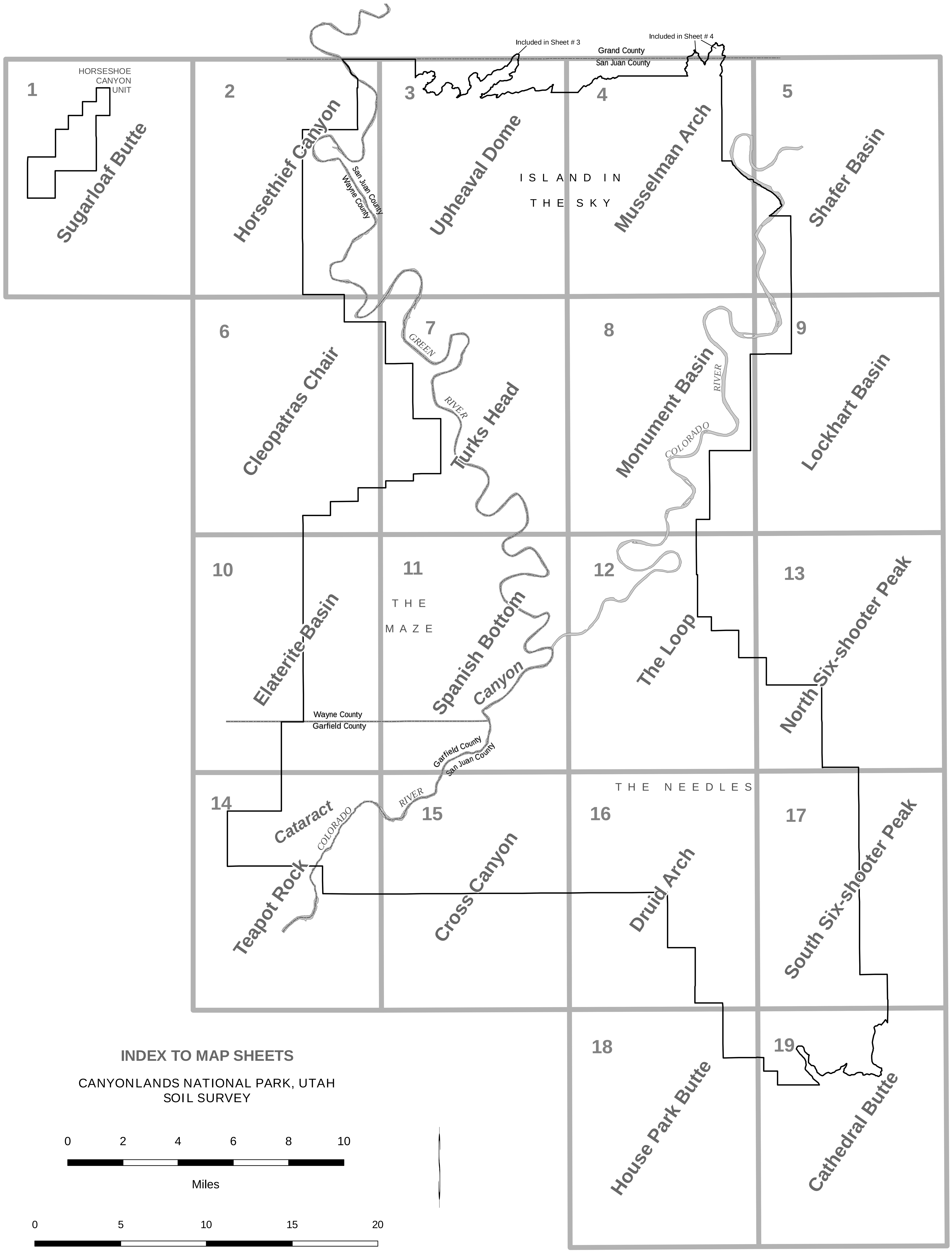
- 3 - Torriorthents-Rock outcrop-Badland association, gently sloping to very steep
- 4 - Reef-Rock outcrop-Mathis family association, strongly sloping to very steep, semiarid

Shallow eolian and residual soils on mesas, structural benches, talus slopes, and hills

- 5 - Tsaya family-Moenkopie-Rock outcrop association, nearly level to very steep, arid
- 6 - Rizno-Arches-Rock outcrop association, nearly level to steep, semiarid
- 7 - Rock outcrop-Arches-Nalcase association, nearly level to steep, semiarid

Deep eolian and slope alluvium soils on mesas and structural benches, in valleys and grabens

- 8 - Mido-Begay association, nearly level to steep, semiarid



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CANYONLANDS NATIONAL PARK, UTAH
SOIL SURVEY

lopes
cent slopes

es
slopes
percent slopes, extremely bouldery
opes
complex, 0 to 6 percent slopes

nt slopes

percent slopes

extremely bouldery

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slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

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County or parish

SPECIAL SYMBOLS FOR SOIL SURVEY

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UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
CATHEDRAL BUTTE QUADRANGLE
SHEET NUMBER 19 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

1 0.5 0 1
Miles

0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH

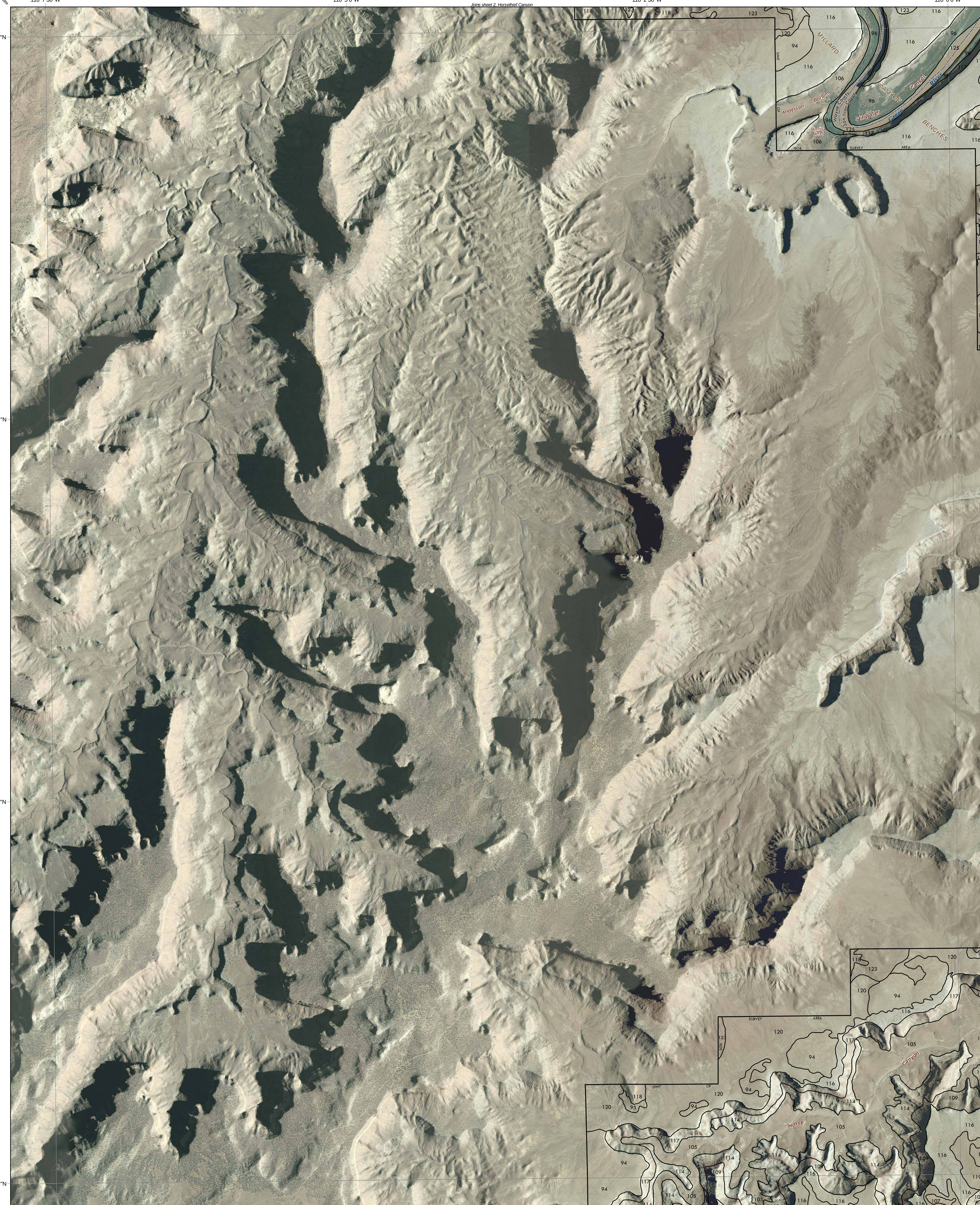
CANYONLANDS
NATIONAL PARK, UTAH

SHEET 19 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
CLEOPATRAS CHAIR QUADRANGLE
SHEET NUMBER 6 OF 19



This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

1 0.5 0 1
Miles

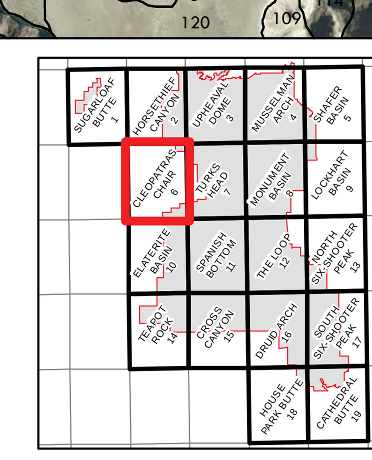
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH



CANYONLANDS
NATIONAL PARK, UTAH

SHEET 6 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
CROSS CANYON QUADRANGLE
SHEET NUMBER 15 OF 19

Joins sheet 10, Elaterite Basin
Joins sheet 11, Spanish Bottom
Joins sheet 12, The Loop
Joins sheet 14, Teapot Rock
Joins sheet 16, Druid Arch
Joins sheet 18, House Park Butte

110°0'0"W 109°57'30"W 109°55'0"W 109°52'30"W

38°7'30"N 38°5'0"N 38°2'30"N 38°0'0"N

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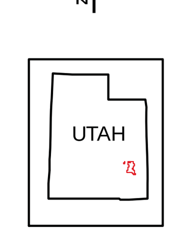
Miles: 1 0.5 0 1

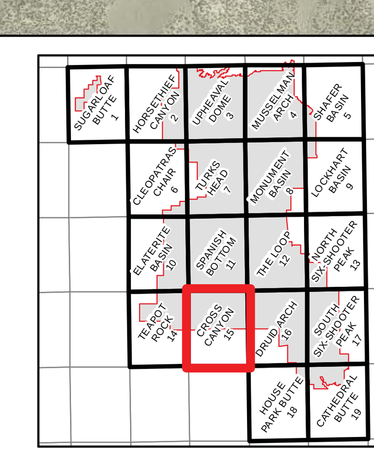
Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 15 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
DRUID ARCH QUADRANGLE
SHEET NUMBER 16 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

Miles: 1 0.5 0 1

Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N

UTAH

CANYONLANDS
NATIONAL PARK, UTAH

SHEET 16 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
ELATERITE BASIN QUADRANGLE
SHEET NUMBER 10 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

1 0.5 0 1
Miles

0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH

CANYONLANDS
NATIONAL PARK, UTAH

SHEET 10 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

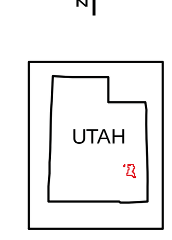
Miles: 1 0.5 0 1

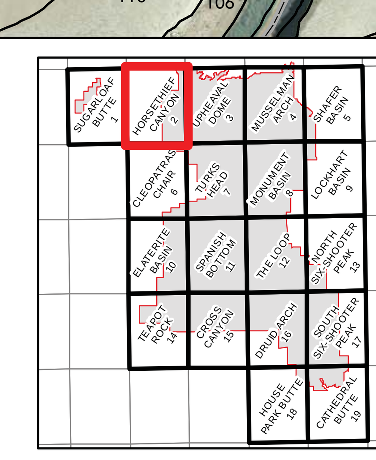
Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
HOUSE PARK BUTTE QUADRANGLE
SHEET NUMBER 18 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NATIONAL PARK SERVICE

NRCS Natural Resources Conservation Service

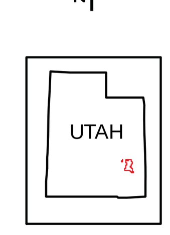
1 0.5 0 1
Miles

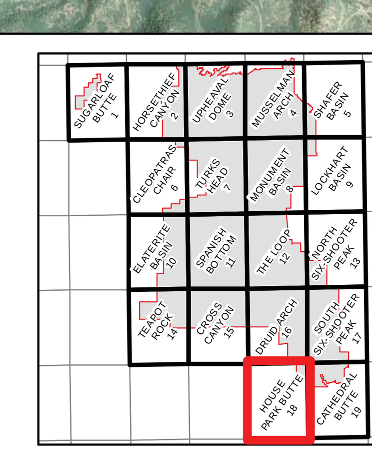
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 18 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
LOCKHART BASIN QUADRANGLE
SHEET NUMBER 9 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

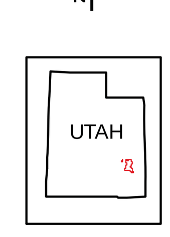
1 0.5 0 1
Miles

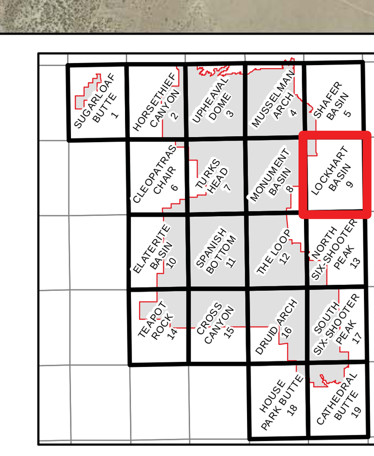
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 9 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
MONUMENT BASIN QUADRANGLE
SHEET NUMBER 8 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

1 0.5 0 1
Miles

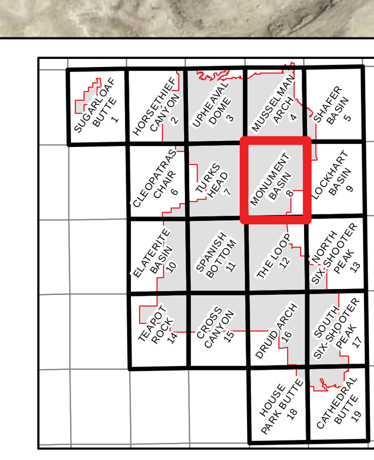
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH



CANYONLANDS
NATIONAL PARK, UTAH

SHEET 8 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

109°52'30"W 109°50'0"W 109°47'30"W 109°45'0"W

38°30'0"N

38°27'30"N
38°25'0"N
38°22'30"N

Joins sheet 3, Upheaval Dome
Joins sheet 5, Shafer Basin
Joins sheet 7, Turks Head
Joins sheet 8, Monument Basin
Joins sheet 9, Lockhart Basin

109°52'30"W 109°50'0"W 109°47'30"W 109°45'0"W

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

0.8 0.4 0 0.8
Miles

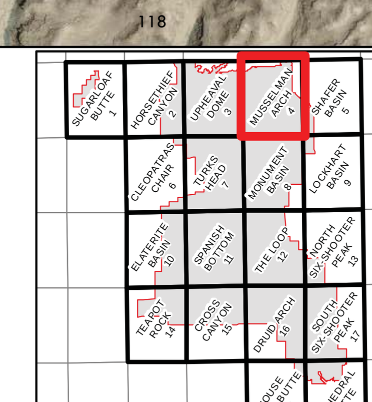
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH



CANYONLANDS
NATIONAL PARK, UTAH

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
NORTH SIX-SHOOTER PEAK QUADRANGLE
SHEET NUMBER 13 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

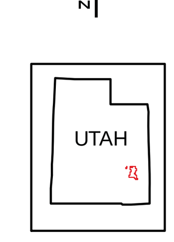
1 0.5 0 1
Miles

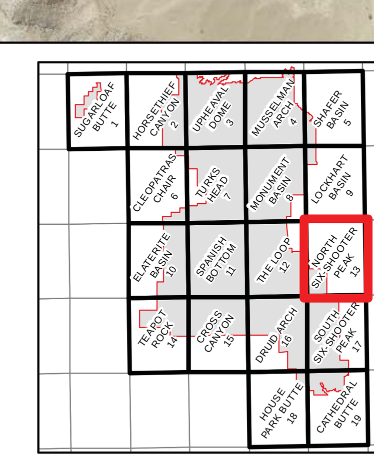
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 13 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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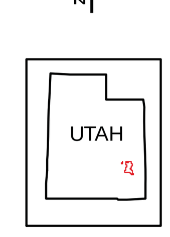
1 0.5 0 1
Miles

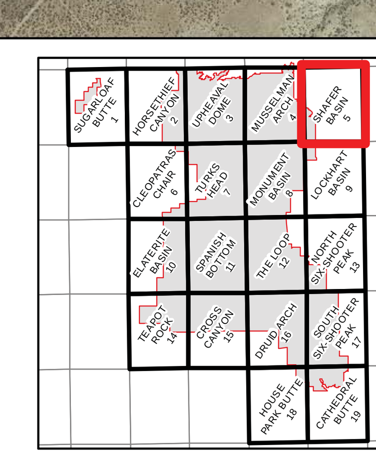
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 5 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
SOUTH SIX-SHOOTER PEAK QUADRANGLE

Joins sheet 12, The Loop

109°45'0"W 109°42'30"W 109°40'0"W 109°37'30"W

Joins sheet 13, North Six-shooter Peak

Joins sheet 16, Druid Arch

Joins sheet 17, South Six-shooter Peak

109°45'0"W 109°42'30"W 109°40'0"W 109°37'30"W

Joins sheet 19, Cathedral Butte

Joins sheet 18, House Park Butte

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

Miles: 1 0.5 0 1

Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N

UTAH

CANYONLANDS
NATIONAL PARK, UTAH

SHEET 17 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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NRCS Natural Resources Conservation Service

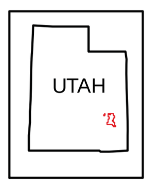
Miles: 1 0.5 0 1

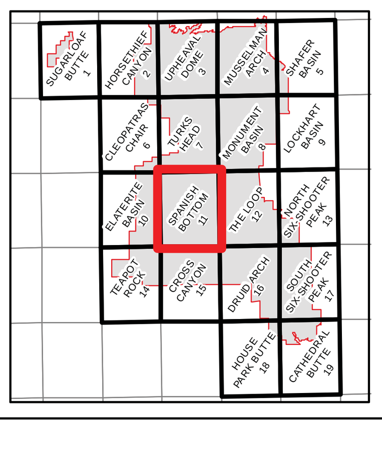
Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N





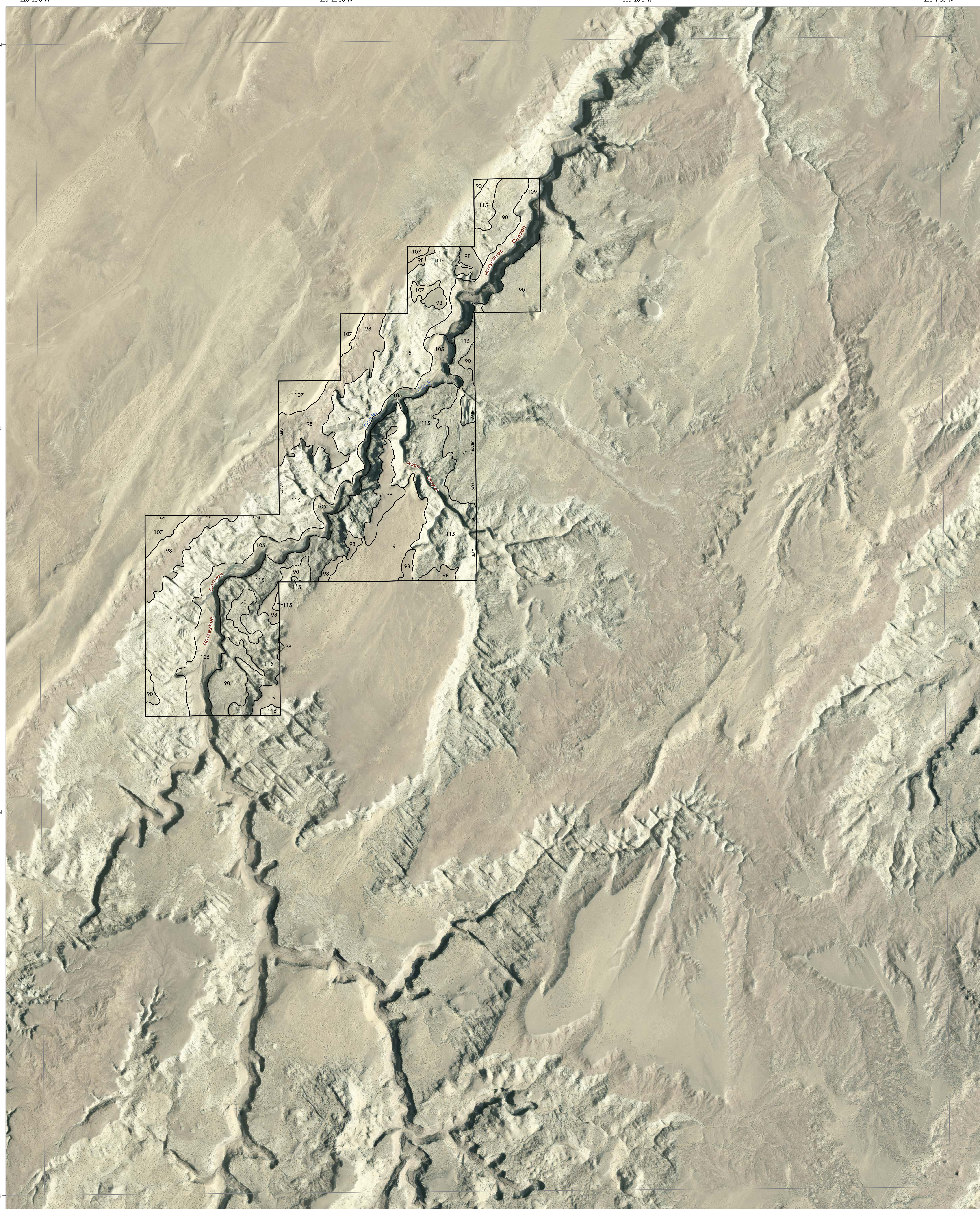
CANYONLANDS
NATIONAL PARK, UTAH

SHEET 11 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
SUGARLOAF BUTTE QUADRANGLE
SHEET NUMBER 1 OF 19



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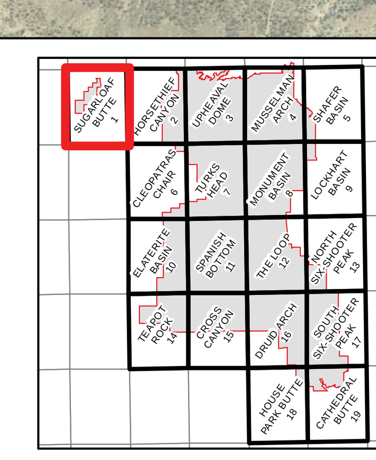
Miles: 1 0.5 0 1
Kilometers: 0 1 2 4
Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N

UTAH

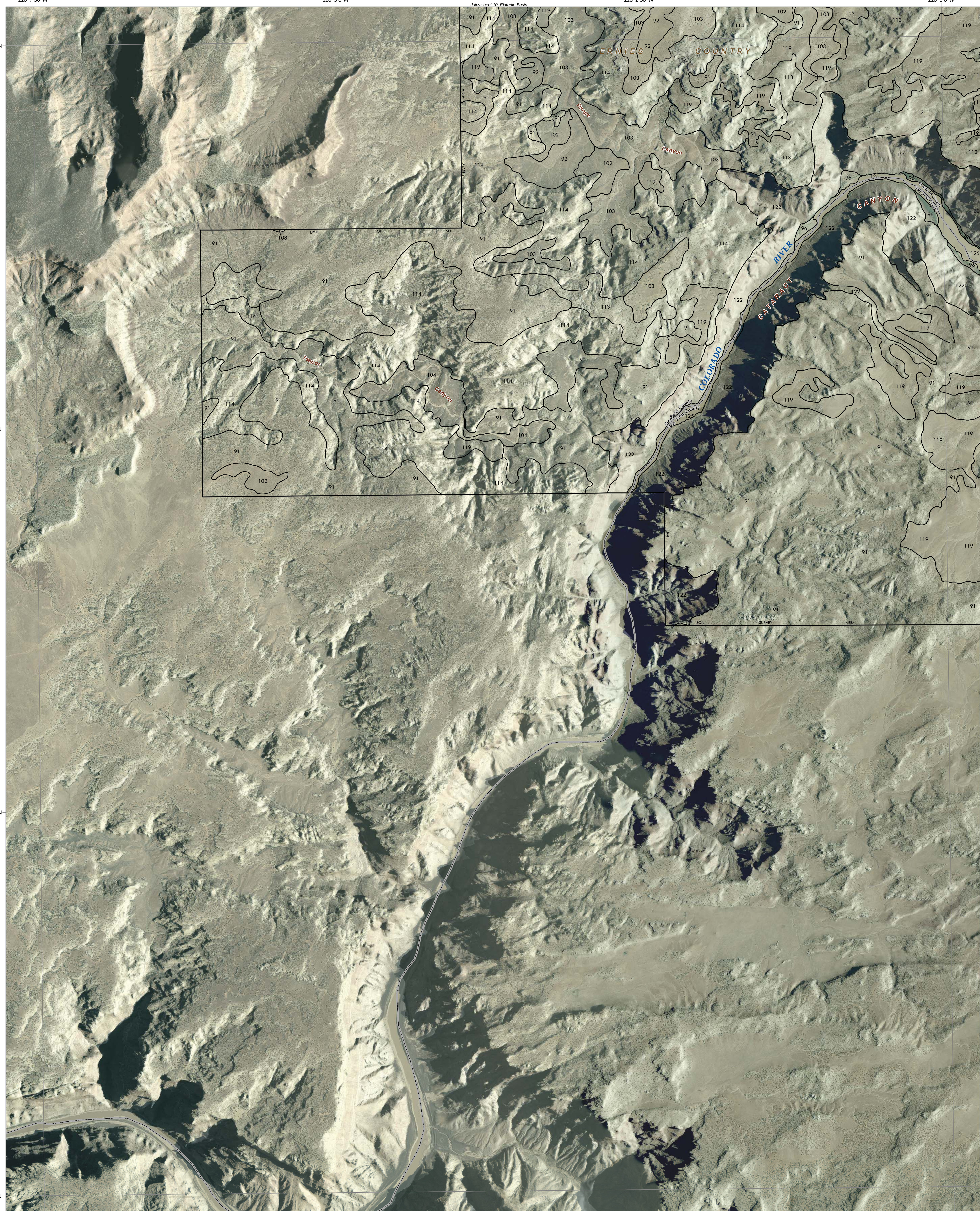


CANYONLANDS
NATIONAL PARK, UTAH

SHEET 1 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE



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Miles: 1 0.5 0 1

Kilometers: 0 1 2 4

Feet: 0 3,750 7,500 15,000

SCALE 1:24,000

N

UTAH

CANYONLANDS
NATIONAL PARK, UTAH

SHEET 14 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
THE LOOP QUADRANGLE
SHEET NUMBER 12 OF 19

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

1 0.5 0 1
Miles

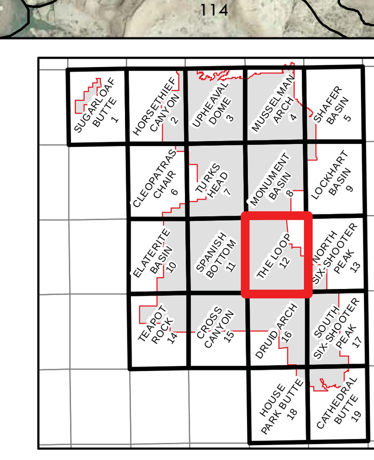
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH



CANYONLANDS
NATIONAL PARK, UTAH

SHEET 12 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
TURKS HEAD QUADRANGLE
SHEET NUMBER 7 OF 19

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1 0.5 0 1
Miles

0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N

UTAH

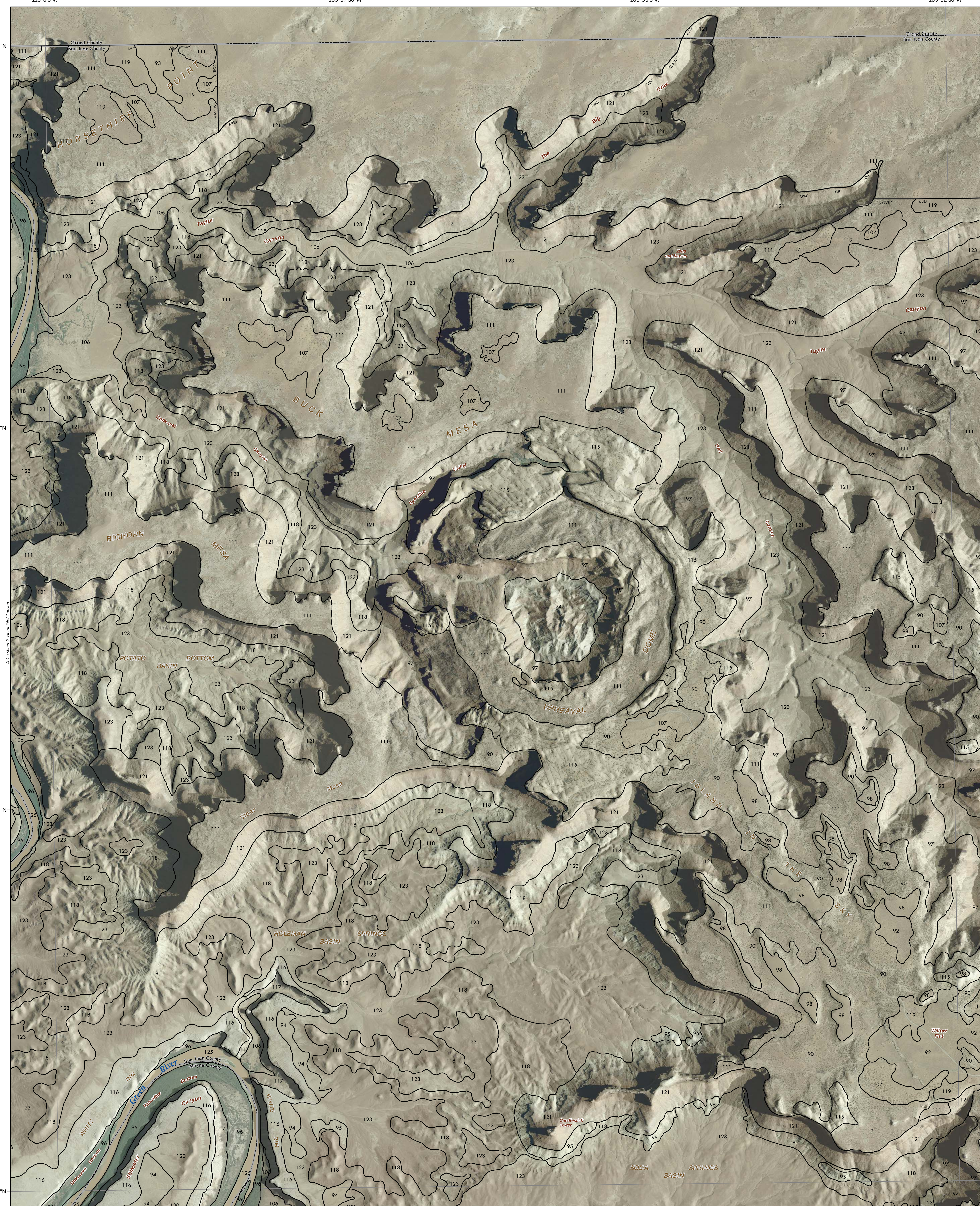
CANYONLANDS
NATIONAL PARK, UTAH

SHEET 7 OF 19

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF CANYONLANDS NATIONAL PARK, UTAH
UPHEAVAL DOME QUADRANGLE
SHEET NUMBER 3 OF 19



This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2006 aerial photography. Cultural information was acquired from USGS topo maps and other sources. Hydro information was derived from USGS topo maps and orthophotography. Park Boundary information was obtained from the National Park Service - 2008. Shaded relief background was created from 10 meter NED elevation data from USDA/NRCS. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Canyonlands National Park, Utah, October, 2010. North American Datum of 1983 (NAD83).

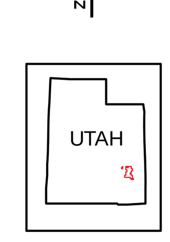
1 0.5 0 1
Miles

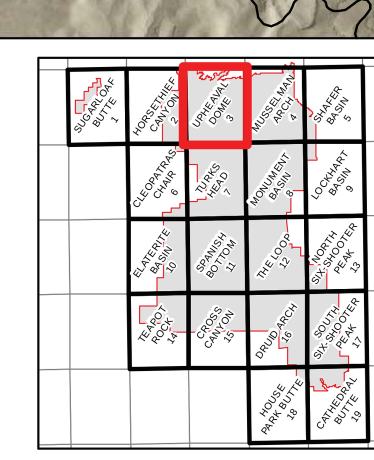
0 1 2 4
Kilometers

0 3,750 7,500 15,000
Feet

SCALE 1:24,000

N





CANYONLANDS
NATIONAL PARK, UTAH

SHEET 3 OF 19